JOURNAL OF THE
American Geriatrics Society
Official Journal of the American Geriatrics Society

Volume IX *January, 1961* Number 1

PERIPHERAL ARTERIOSCLEROTIC ANEURYSM*†

E. STANLEY CRAWFORD, M.D., WILLIAM H. EDWARDS, M.D., MICHAEL E. DEBAKEY, M.D., DENTON A. COOLEY, M.D. AND GEORGE C. MORRIS, JR., M.D.

The Cora and Webb Mading Department of Surgery, Baylor University College of Medicine and the Jefferson Davis, Methodist, and Veterans Administration Hospitals, Houston, Texas

Peripheral arteriosclerotic aneurysms if neglected or improperly treated are eventually complicated by rupture, thrombosis, arterial kinking, and distal emboli which may lead to arterial obstruction, gangrene, amputation and even death. Gangrene requiring amputation occurred in 77 per cent and death in 27 per cent of a series of patients treated conservatively before the development of modern methods of therapy and later reviewed by Linton (1). Similar results were noted by Gifford and associates in a review of 100 cases of popliteal aneurysm (2). The incidence of peripheral arteriosclerotic aneurysm, generally considered rare, is increasing as a result of *a*) greater frequency of recognition, and *b*) the continuous extension of life expectancy for persons in the older age group, who are particularly susceptible to the complications of arteriosclerosis. In fact, this disease is the second most common cause of arterial insufficiency of the lower extremities, second only to atherosclerotic occlusive vascular disease.

Delayed local excision without arterial replacement, combined with preliminary lumbar sympathectomy, was the method of therapy widely employed for peripheral aneurysm during the twenty-year period ranging approximately from 1935 to 1955. Although this method was a significant improvement in the treatment of these lesions, when employed electively before the onset of arterial insufficiency, intermittent claudication usually continued or developed after operation. Moreover, this procedure, not restoring a distal pulsatile blood flow, was usually ineffective in the more advanced cases associated with rest-pain and gangrene. With the development of technics of arterial reconstruction, a method of therapy became available by which the lesion could be excised and a pulsatile blood flow restored either by end-to-end anastomosis or by the use of grafts (3–5). During the past eight years we have employed this form of therapy in the treatment of 150 peripheral aneurysms, of which 88 were of arteriosclerotic origin. This report is concerned with certain observations derived from data on the latter cases.

* Presented at the 17th Annual Meeting of The American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Supported in part by the United States Public Health Service under Grants H-3137 and HTS-5387, and the Houston Heart Association.

CLINICAL MATERIAL

This study of peripheral arteriosclerotic aneurysm included 72 patients with 88 aneurysms. There were 71 men and 1 woman, and their ages ranged from 45 to 85 years, with 95 per cent in the sixth and seventh decades of life. The woman had a history of blunt trauma, so although arteriosclerosis was present in the lesion it may have been of traumatic origin.

LOCATION AND EXTENT OF DISEASE

The aneurysms were fusiform in nature and located in the femoral artery in 39 cases (44 per cent), the popliteal artery in 47 (53 per cent), the subclavian artery in 1 (1.5 per cent), and the bifurcation of the innominate artery in the neck in 1 (1.5 per cent) (Table 1). Multiple aneurysms were frequent, being present in 51 patients (70 per cent) (Table 2). Aneurysms were present in both popliteal arteries in 13 patients (18 per cent), in both femoral arteries in 9 (12 per cent), in the femoral and popliteal arteries in 6 (8 per cent), and associated with aneurysms of the aorta and/or iliac arteries in 23 (32 per cent).

When an aneurysm was located in the femoral artery it usually involved only the common femoral artery, although occasionally there was extension down into the proximal few centimeters of both the superficial and deep femoral vessels. In some cases, the superficial femoral artery was secondarily involved by atherosclerotic occlusive vascular disease or organized thrombus, but usually this occlusion was segmental in nature, with patency of the popliteal artery

TABLE 1

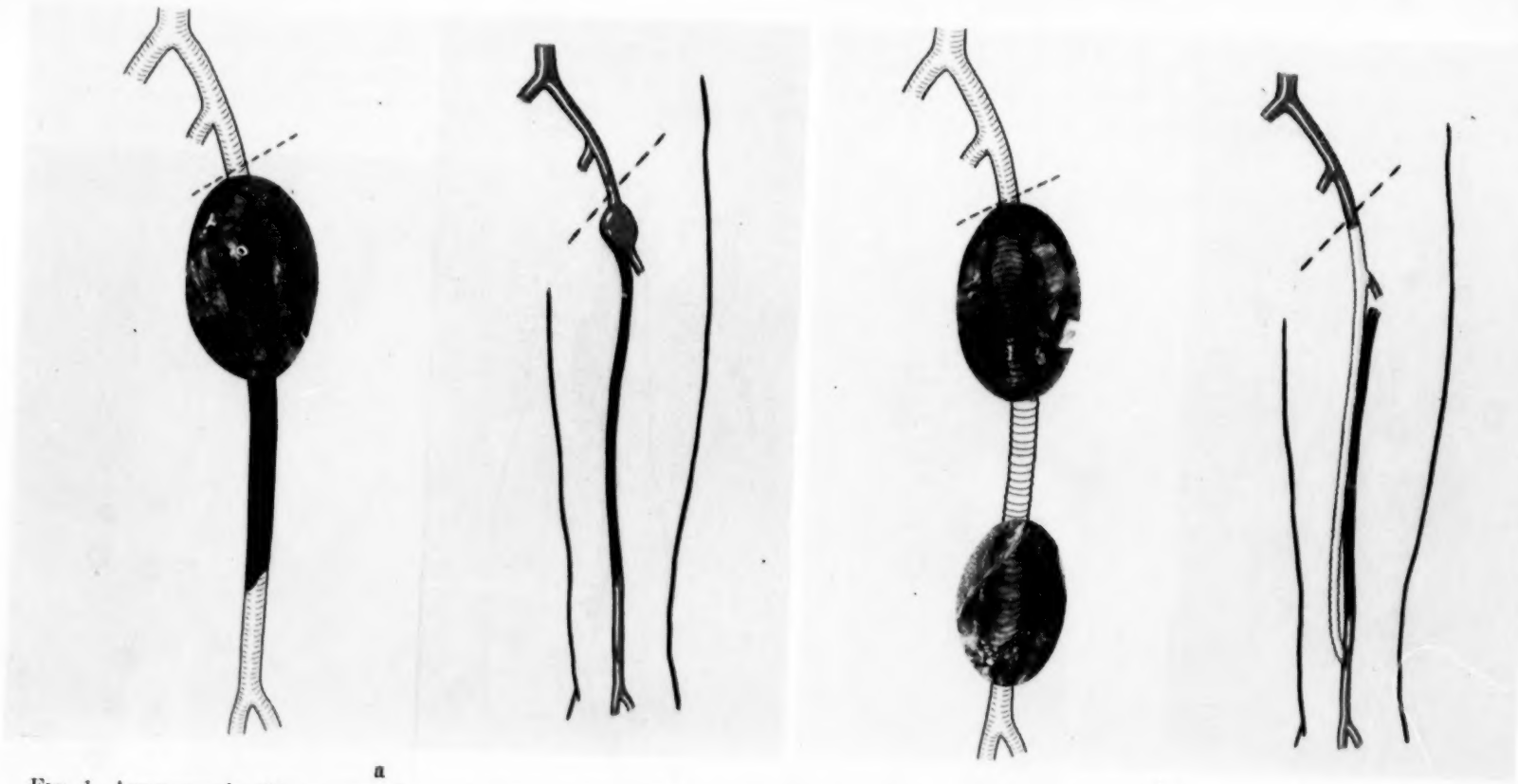
Location of 88 Surgically Treated Peripheral Arteriosclerotic Aneurysms in 72 Patients

Location	No. of Cases	Per Cent
Popliteal artery	47	53
Femoral artery	39	44
Innominate artery bifurcation	1	1.5
Subclavian artery	1	1.5
Total	88	100

TABLE 2

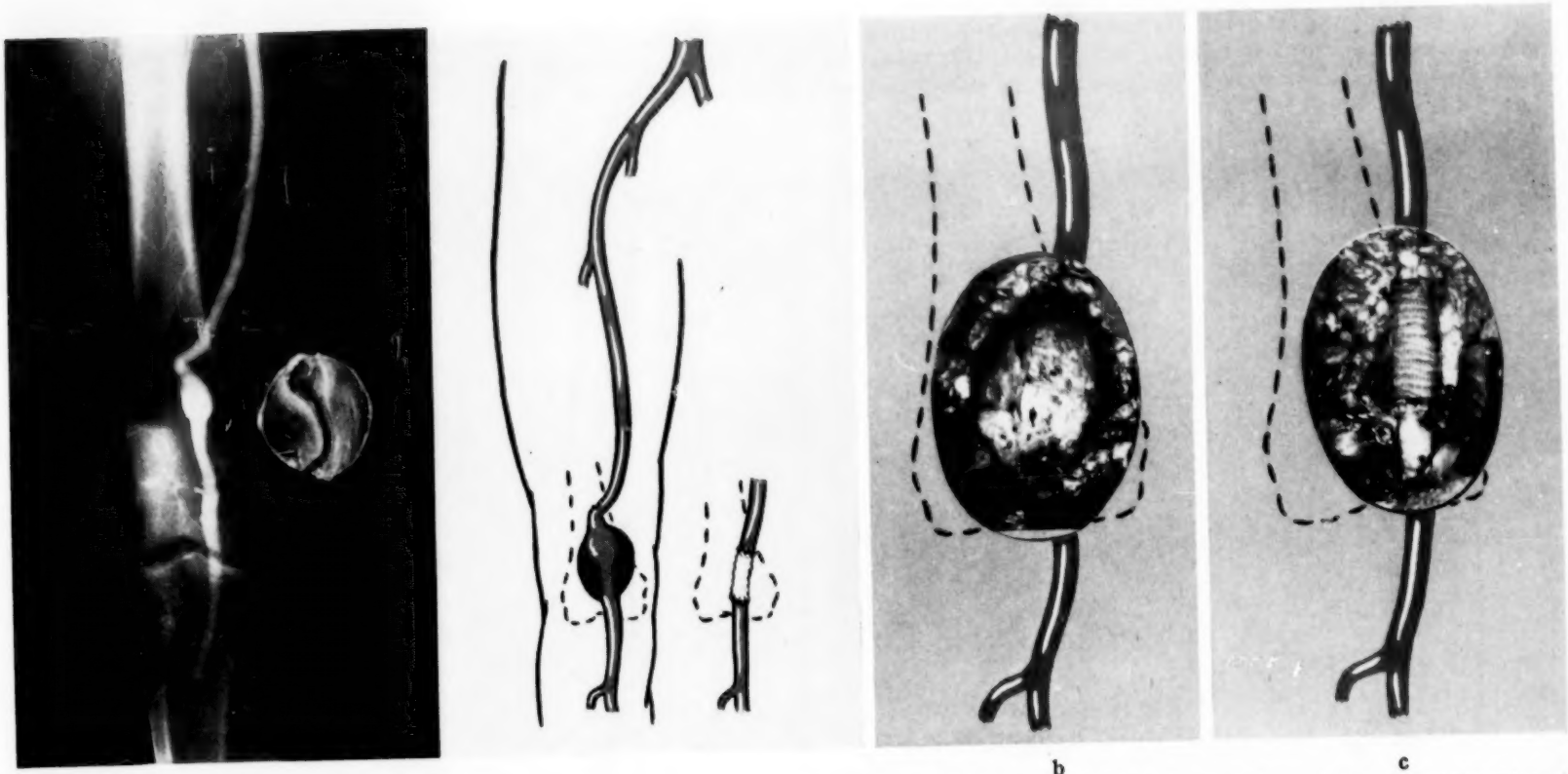
Incidence of Multiple Aneurysms in 72 Patients with Peripheral Arteriosclerotic Aneurysms

Location of Aneurysms	No. of Patients	Per Cent
Bilateral, popliteal	13	18
Bilateral, femoral	9	12
Femoral and popliteal	6	8
Associated with aortic or iliac aneurysm	23	32
Total	51	70



a b

FIG. 1. Aneurysm in the common femoral artery and associated distal atherosclerotic occlusive disease. (**a**) Photograph at operation and diagram showing the aneurysm extending into the proximal segments of the superficial and deep femoral arteries, and (in black) the distal occlusion. (**b**) Photograph and diagram showing graft replacing the aneurysm and by-passing obstruction.



a b c

FIG. 2. Aneurysm of the popliteal artery treated by excision and replacement with a graft. (**a**) Arteriogram (superimposed specimen) and diagram showing the aneurysm treated by excision and grafting. (**b**) Photograph at operation showing the aneurysm localized to popliteal artery. (**c**) Photograph at end of operation showing Dacron graft replacing the aneurysm.

(Fig. 1). The deep femoral artery (profunda femoris), on the other hand, was patent in every patient. Thus, in these cases of aneurysm of the femoral artery, a reasonably normal patent arterial segment was present both above and below the lesion, making possible the surgical reconstruction of the artery with restoration of distal blood flow.

Aneurysms of the popliteal artery were usually localized to the main popliteal artery at some point between the adductor hiatus and the origin of the anterior tibial artery (Fig. 2). A sizable normal distal segment of artery was present in all cases; however, the vessel distal to the aneurysm was occasionally occluded by thrombus, particularly when there was thrombosis in the aneurysm. In the presence of thrombosis, surgical reconstruction to restore the distal circulation was possible in the cases with good collateral circulation (which prevented distal extension of thrombus) and the cases operated upon soon after thrombosis (at which time the thrombus could be removed from the distal segment not involved by aneurysm). In the absence of secondary distal occlusion, the disease was well localized and ideally suited to reconstructive operation.

In 3 patients, the aneurysm diffusely involved the entire superficial femoral and proximal popliteal arteries; nonetheless, normal patent arterial segments were present both above and below the lesion. Aneurysms involving the subclavian artery and the bifurcation of the innominate artery presented as masses in the supraclavicular region; they also were associated with normal patent segments both above and below the aneurysm.

CLINICAL MANIFESTATIONS

In most of the 88 cases the disease was fairly well advanced; one or more major complications had occurred in all but 6 (7 per cent) (Table 3). Thrombosis had occurred in 19 (27 per cent), rupture in 8 (11 per cent), peripheral arterial insufficiency in 48 (66 per cent), previous amputation of the contralateral leg for aneurysm in 5 (7 per cent), and rupture of an associated abdominal aortic aneurysm in 2 (3 per cent). Because of these complications the 72 patients had a variety of characteristic symptoms (Table 4). Intermittent claudication in the lower legs and feet was present in 40 (55 per cent), and severe continuous ischemic pain of the lower legs and feet in 8 (11 per cent). Only 44 (62 per cent) of the patients were aware of a mass described as pulsatile in 11, painful in 14,

TABLE 3

The Presenting Complications Associated with 88 Arteriosclerotic Aneurysms

Complication	No. of Cases	Per Cent
Thrombosis	19	27
Rupture	8	11
Arterial insufficiency	48	66
Previous amputation of contralateral leg for aneurysm	5	7
Rupture of associated abdominal aortic aneurysm	2	3

TABLE 4

Symptoms in 72 Patients with Peripheral Arteriosclerotic Aneurysms

Symptoms	No. of Patients	Per Cent
Aneursymal mass	44	62
pulsatile 11		
painful 14		
enlarging 5		
Local pain (patient unaware of mass)	4	6
Intermittent claudication	40	55
Pain at rest	8	11
No related symptoms	5	7

and enlarging in 5 patients. The complaint in 4 patients was pain in the region of the aneurysm; however, the presence of a mass was unknown to these patients. Only 5 (7 per cent) of the 72 patients were asymptomatic, the aneurysm having been found incidentally on physical examination.

On physical examination, the aneurysms were palpable in the respective regions. The large ones were visible because of their size and the fact that they were pulsatile unless thrombosed. Recently thrombosed aneurysms were non-pulsatile and tender. Non-thrombosed aneurysms, particularly in stout or obese patients, were palpable as widened areas of pulsation either in the groin or popliteal space. Definite masses were not always obvious. Ruptured aneurysms were evident as painful swellings in the region of the groin or popliteal space. The area of swelling frequently was pulsatile and discolored from extravasated blood.

A most important criterion was the presence or absence of distal pulses in the feet. The presence of these pulses indicates localized disease that is invariably amenable to a simple reconstructive operation. The absence of these pulses indicates advanced extensive disease associated with arterial occlusion. Although the latter cases are frequently amenable to reconstructive operation, the procedure required for restoration of the circulation is usually extensive and requires great skill for success; even so, due to the extent of the associated arterial occlusion, circulation cannot always be restored. In the group of cases involving 82 affected extremities (Table 8), pedal pulses were absent in 41 (50 per cent), indicating a high incidence of extensive disease.

ASSOCIATED DISEASES

There was a high incidence of associated disease in this series (Table 5). Heart disease, usually in the form of previous myocardial infarction, was present in 34 patients (48 per cent). When the resting systolic blood pressure was above 150 mm. Hg or the diastolic pressure above 90 mm., patients were classified as having hypertension. On this basis, 30 patients (42 per cent) had hypertension. Other aneurysms were present in 51 patients (70 per cent), and 4 patients (6 per cent) had had previous cerebrovascular accidents. Because of the relative

TABLE 5

Incidence of Associated Cardiovascular Disease in 72 Patients with Peripheral Arteriosclerotic Aneurysms

Disease	No. of Patients	Per Cent
Heart disease	34	48
Hypertension	30	42
Previous cerebrovascular accident	4	6
Other aneurysms	51	70

TABLE 6

Primary Operations Employed in the Treatment of 88 Peripheral Arteriosclerotic Aneurysms

Operation	No. of Cases	Per Cent	Successful Results*	
			No. of Cases	Per Cent
Excision and replacement by grafting	61	70	55	90
By-pass by grafting	12	14	11	92
Excision and end-to-end anastomosis	14	15	12	85
Primary amputation	1	1		0
Total	88	100	78	90

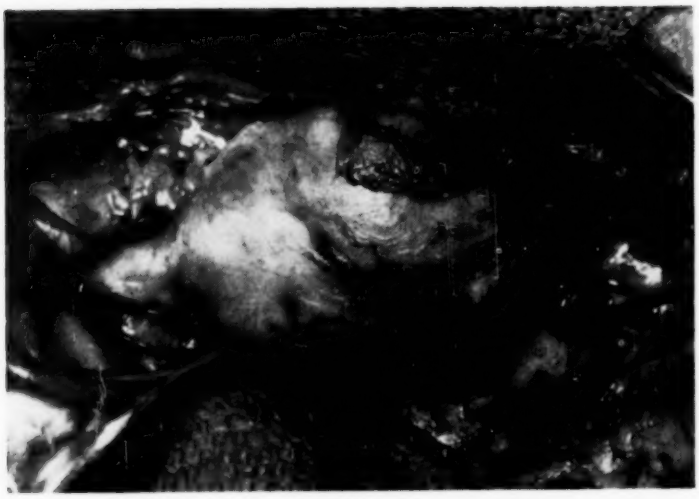
* Failures included amputation in 6 other patients and death in 4 patients.

simplicity of the surgical procedure and the compelling indications for it, these associated diseases were not considered contraindications to operation.

SURGICAL PROCEDURES

Therapy was directed toward excision of the lesion and restoration of normal blood flow in all but 1 case (partial decomposition of the lower leg and foot). This procedure was chosen despite the fact that arterial insufficiency and absence of pulses characterized 50 per cent of the 88 cases and there was actual gangrene in 6 cases. Primary amputation was employed in 1 case with gangrene and the type of arterial reconstructive operation employed in the other cases was dependent upon the location and extent of the aneurysm and the presence of secondary distal arterial occlusion (Table 6). The aneurysm involved a relatively short segment of artery in 14 of the 88 cases (15 per cent). These were treated by excision and restoration of arterial continuity by means of end-to-end anastomosis, using simple over-and-over sutures (Fig. 3). In some of the earlier cases it was necessary to undertake mobilization of the artery above and below the aneurysm and flexion of the hip or knee, as originally recommended by Enderlen (6), in order to bring the segments together without excessive tension. Flexion of the hip or knee was maintained by a plaster cast for seven to fourteen days. In recent cases, this type of treatment was abandoned because stiffness and joint symptoms developed following such immobilization in older patients.

a



b

c

FIG. 3. Aneurysm of the popliteal artery treated by excision and anastomosis. (**a**) Arteriogram and superimposed specimen showing aneurysm containing laminated thrombus. (**b**) Photograph at operation showing the aneurysm. (**c**) Photograph at operation showing suture line following excision of aneurysm and end-to-end anastomosis.

Excision of the aneurysm and end-to-end anastomosis is now considered the procedure of choice only when the involved arterial segments are short, permitting anastomosis in association with mobile joints.

In 61 of the 88 cases (70 per cent) the aneurysm involved a relatively long segment of artery. After excision of the aneurysm in these cases, an arterial replacement was required to bridge the gap and restore arterial continuity (Fig. 2). The most suitable graft material available was inserted by end-to-end anastomosis, using simple over-and-over sutures. In cases of common femoral aneurysm which involved the proximal superficial and deep femoral arteries, arterial continuity with both the distal segments remaining after excision was restored: 1) by using a small bifurcated graft sutured proximally to the uninvolved segment of the common femoral artery and distally to the uninvolved segments of the superficial and deep femoral arteries, or 2) by suturing the uninvolved distal segment of the profunda femoris to the side of the graft, before or after the graft was sutured to the uninvolved segments of the common femoral and superficial femoral arteries—as applied in most cases in which non-fraying Dacron grafts are used.

The disease in 12 of the 88 cases (14 per cent) was associated with multiple aneurysms, distal arteriosclerotic occlusive vascular disease, or extensive thrombosis. The principle of by-pass grafting was adopted in these instances (Table 6).

In patients with a patent (pulsatile) aneurysm and secondary distal occlusion, the procedure (Fig. 1) was carried out by replacing the excised aneurysm and by-passing the remaining occluded segment by a long graft. The proximal end of the graft was inserted at the site of the former proximal end of the aneurysm, and the distal end of the graft (drawn through a tunnel fashioned by blunt dissection) was inserted into an incision made in the patent artery distal to the occluded segment. In this way, the occluded segment was by-passed.

In some cases of aneurysmal thrombosis with both proximal and distal extension of organized thrombus, the entire segment was by-passed leaving the region of disease undisturbed. This was accomplished by attaching the ends of the graft respectively to the uninvolved artery above, and to the uninvolved artery below the diseased area.

In 3 patients the entire superficial femoral and proximal popliteal arteries were involved in the aneurysmal process. To simplify the operation in these cases, the diseased segment was isolated and allowed to thrombose, and distal blood flow was restored by inserting a by-pass graft. Sections of the normal arteries were exposed above and below the diseased area, through two small separate incisions; the artery was transected in each incision. The arterial segment adjacent to the aneurysmal segment was ligated or oversewn in each wound. Then, one end of a long graft was sutured to the proximal uninvolved segment in the upper incision and the other end of the graft was sutured to the end of the distal arterial segment in the lower incision. The graft was drawn subcutaneously from one incision to the other through a tunnel made by blunt dissection, leaving the isolated aneurysmal segment in situ to thrombose and become obliterated.

Two patients had aneurysms of the abdominal aorta, and the common iliac

and femoral arteries associated with atherosclerotic and thrombotic occlusion of the external iliac and superficial femoral arteries (Fig. 4). The aneurysms were excised and distal pulsatile circulation was restored in the following manner, using a long bifurcation graft (Fig. 4): The end of the abdominal segment of the graft was sutured to the uninvolved proximal end of the abdominal aorta. One end of the graft was drawn into an incision in the right groin through a tunnel made by blunt dissection behind the peritoneum and along the iliac vessels. The uninvolved distal segment of the profunda femoris was sutured to the side of the graft and the distal end of the graft was drawn through a second tunnel into a third incision made behind the knee. The end of the graft was then sutured to the side of the patent popliteal artery distal to all the disease. The other limb of the long graft was employed on the left side for restoring circulation into the left lower extremity, thus completing the operation.

Homografts, braided Nylon (Edwards-Tapp) tubes, and flexible knitted Dacron tubes were employed as grafts (Table 7). These replacements were used in order of availability, starting with homografts. Flexible knitted Dacron grafts have provided the best technical and functional results in peripheral vascular operations, and we have used this material exclusively during the past three and a half years (Figs. 1, 2 and 4).

RESULTS OF OPERATION

Despite the operative risk and the advanced stage of the disease in most instances, the results of operation were satisfactory (Table 6–8). The operation was considered successful only if the aneurysm was excised or rendered harmless (exclusion procedures), if circulation was restored in the region of operation, and the patient was discharged alive without amputation. On this basis, arterial reconstructive therapy was successful in 78 of 88 operations for aneurysm (90 per cent). Amputation was required in 6 of the 7 patients admitted with relatively advanced gangrene of the foot and/or toes. The gangrenous process was so extensive in 1 of these cases that arterial reconstruction was not attempted. There were 4 deaths—1 from complications resulting from rupture of an abdominal aortic aneurysm which had precipitated admission, 2 from myocardial infarction, and 1 from air embolism resulting from a transfusion accident during operation.

The most important single factor influencing the functional results of therapy was arterial occlusion (Table 8). In 41 of 82 involved extremities (50 per cent) pedal pulses were absent beyond the aneurysm, indicating secondary arterial obstruction due either to thrombosis, rupture, embolism, kinking or secondary atherosclerosis. All of the deaths and 5 of the 6 amputations occurred in this group of 41 cases. Despite these complications, pulses were restored and all symptoms relieved in 27 cases (66 per cent). An additional 5 patients in this group with no pedal pulses survived operation and had circulation restored following repair of the aneurysm; amputation was avoided, but mild intermittent claudication continued. In 40 of 41 extremities (97 per cent) in which pedal pulses were present at the time of operation, the aneurysm was successfully

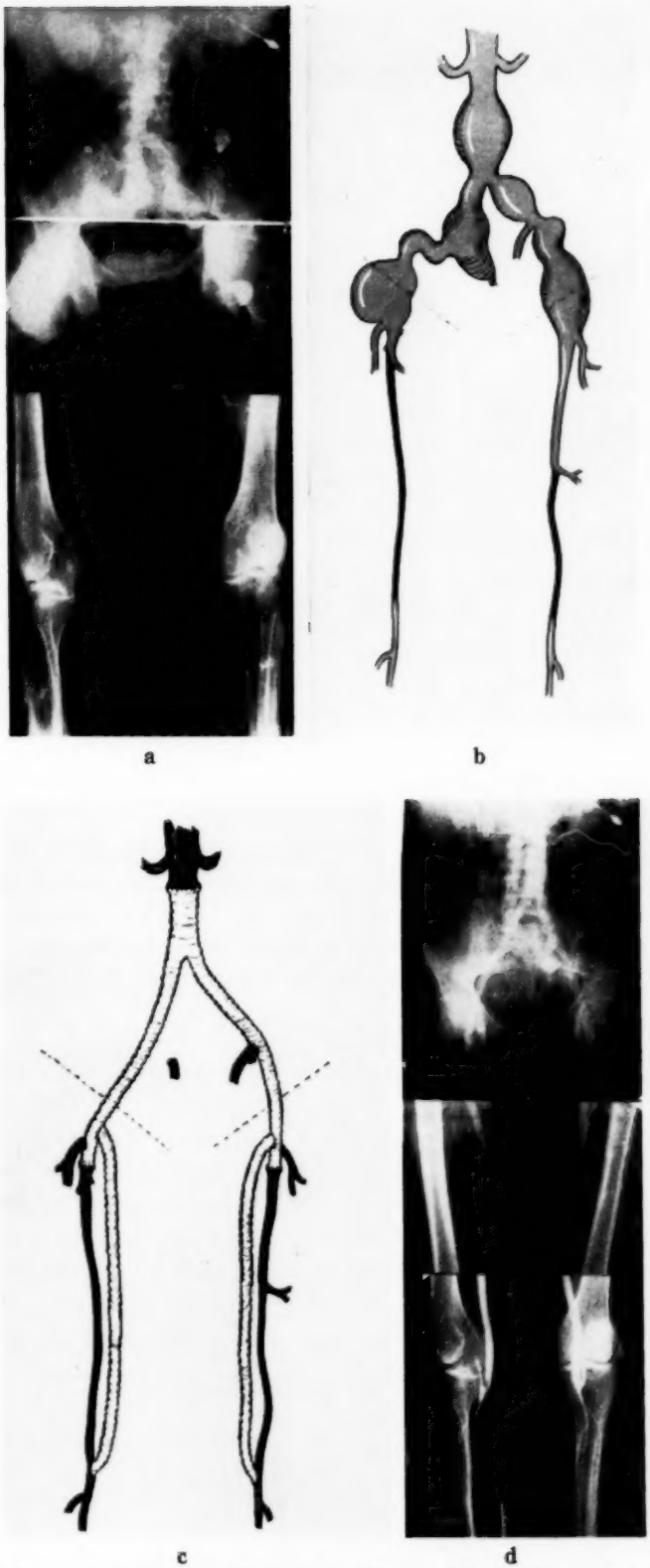


FIG. 4. Multiple aneurysms (abdominal aorta, iliac and femoral arteries) with secondary occlusion of the iliac and superficial femoral arteries, treated by grafting. (**a**) Aortogram before operation, showing lesions. (**b**) Diagram showing aneurysms, and (in black) the occlusions. (**c**) Diagram showing grafts replacing aneurysms and by-passing the obstruction of the iliac and femoral arteries. (**d**) Aortogram after operation, showing functioning graft in place.

TABLE 7

Types of Arterial Replacement Employed in the Treatment of 74 Peripheral Arteriosclerotic Aneurysms

Type of Replacement	No. of Cases	Per Cent	Successful Results	
			No. of Cases	Per Cent
Homograft	14	19	13	85
Edwards-Tapp Nylon tube	4	5	3	75
Dacron tube	56	76	50	89
Total	74	100	66	89

TABLE 8

*Results of Operation Based Upon Changes in Pedal Circulation in the Involved 82 Extremities**

Status of Pedal Pulses Before Operation	No. of Cases	Per Cent	Results			
			Pulse Restored		Amputation Necessary	
			No. of Cases	%	No. of Cases	%
Absent	41	50	27	66	5	13
Present	41	50	40	97	1	2
Total	82	100	67	82	6	7

* In 6 cases, femoral and popliteal aneurysms were present in the same extremity.

excised and distal pedal pulses were restored and maintained. In the remaining case, there was postoperative wound infection, requiring removal of the graft and ligation of the proximal and distal arterial segments; this led to gangrene and low-thigh amputation. All patients in this group survived.

All patients were observed at intervals after operation and a complete follow-up has just been completed (June 3, 1960). The length of follow-up was over six years in some instances (Fig. 5). Functional results continue to be satisfactory. No patient required amputation after leaving the hospital. Of the 60 still alive, only 6 have intermittent claudication. In 2 patients, false aneurysms occurring at the suture line necessitated a second reconstructive operation, which was successful in both cases; these patients are now asymptomatic and have good peripheral circulation. Of the 68 patients who survived operation, 8 died from other diseases during the follow-up period—2 from carcinoma, 1 from hepatitis, 1 from ruptured aortic aneurysm, and 4 from unknown causes. These relatively early deaths were not surprising in view of the advanced age of the patients and the high incidence of associated serious disease; in fact, a higher incidence of early death was expected for this reason. Since most of the patients are still alive, the reconstructive vascular operation may be considered more than palliative therapy.

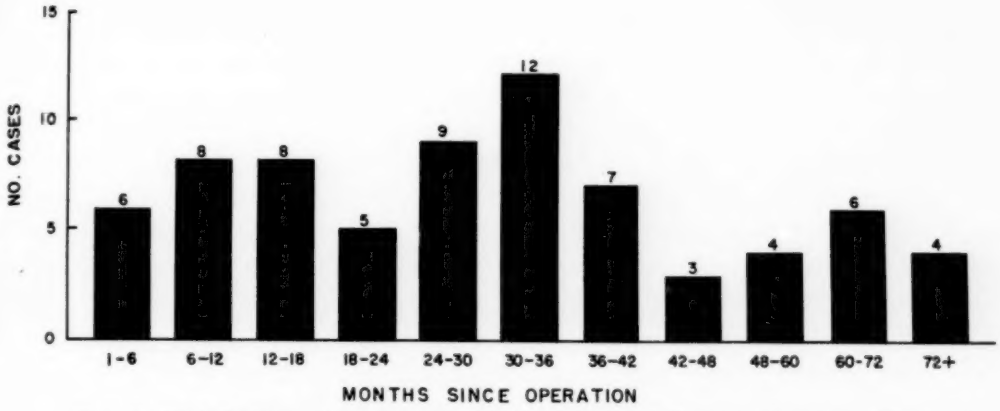


FIG. 5. Distribution of cases according to length of follow-up since operation.

DISCUSSION

Peripheral arteriosclerotic aneurysm is predominantly a disease of older men. In this series of cases, 95 per cent of the patients were well over middle age, and only 1 was of the female sex. In this woman there was some doubt regarding the diagnosis in view of the history of trauma. As peripheral aneurysm is a degenerative lesion, its prevalence in the geriatric age group is to be expected. The practically exclusive predilection for men is not clear, however, and this study does not add to our knowledge in this respect. On the other hand, aortic aneurysm is not uncommon in women, though men are affected ten times more often.

A second interesting and consistent characteristic of peripheral arteriosclerotic aneurysms is their location. Almost all of these lesions occur in the groin or popliteal space, and in many instances they are multiple. There are various theories to account for this fact, but the most likely explanation is "stress arterial fatigue" resulting from chronic motion. The frequency of multiple aneurysms is not surprising, since one of the causal factors, arteriosclerosis, is a diffuse disease. When there is a tendency to form peripheral aneurysms, multiple lesions would be expected, since the anatomic and functional factors are similar in both legs.

The most important practical consideration in the treatment of peripheral aneurysm is the fact that this serious disease causes invalidism and even loss of life or limb, particularly if ignored or neglected. Unfortunately, the incidence of the disease seems to be increasing, so it assumes increasing importance. Our study clearly indicates that arterial reconstructive procedures can be sucessfully employed, with resultant preservation of life, limb and productivity. Moreover, these ideal objectives may be obtained almost invariably, if treatment is started before the onset of complications. For these reasons, the femoral and popliteal regions should always be carefully examined, particularly in older patients; the presence of an aneurysm should not be taken lightly, as the lesion is progressive and eventually serious complications will develop. Early elective operation, before the onset of arterial occlusion, should be the present-day approach to the problem. Even though complications may have already occurred before the

diagnosis is made, reconstructive operation is still the best method of therapy. In this series of cases, operation was successful in most instances despite complications threatening loss of the extremities. There are no clear-cut contraindications to operation. Associated heart disease, hypertension, advanced age and the presence of other aneurysms are not contraindications; 70 per cent of the patients in this series had these diseases. Yet successful operation was possible and the improvement was maintained in most cases. Moreover, most patients also survived the associated diseases after discharge from the hospital, indicating that such an aggressive direct approach to the problem of peripheral aneurysm is not merely palliative.

SUMMARY

The incidence of peripheral arteriosclerotic aneurysm, generally considered a rarity, is increasing due to lengthened life expectancy and greater accuracy in diagnosis. Next to atherosclerotic occlusive disease, aneurysm is the most frequent cause of arterial insufficiency in the lower extremities. The consequences of neglect or improper treatment are thrombosis, arterial kinking, distal emboli, or rupture leading to arterial insufficiency, gangrene or even death.

With the development and application of reconstructive operations in the treatment of segmental arterial disease, a method of therapy is available whereby peripheral aneurysms can be excised and arterial blood flow maintained or restored. This report is concerned with the application of these technics in the treatment of 88 peripheral arteriosclerotic aneurysms in 72 patients.

The patients (71 men and 1 woman) ranged in age from 45 to 85 years; 95 per cent were in the sixth and seventh decades.

Of the 88 aneurysms, 39 (44 per cent) were in the femoral artery, 47 (53 per cent) in the popliteal artery, 1 in the innominate artery, and 1 in the subclavian artery. Fifty-one patients (70 per cent) had multiple aneurysms. Bilateral popliteal aneurysms were present in 13 patients (18 per cent), bilateral femoral in 9 (12 per cent), and a combination of femoral and popliteal in 6 (8 per cent). Associated abdominal aortic or iliac aneurysms, or both, were noted in 23 patients (32 per cent).

Aneurysm of the femoral artery was generally limited by the branching of the common femoral into the deep and superficial femoral arteries. The profunda femoris was patent in all cases, whereas the superficial femoral was often occluded by atherosclerotic lesions. Aneurysm of the popliteal artery was usually located between the adductor hiatus and the bifurcation of the popliteal. Depending upon the patency of the aneurysm, the involved area presented an enlarged pulsating mass, a hard and sometimes tender mass, or simply a widened area of pulsation.

Among the 72 patients, 30 (42 per cent) were hypertensive, and 34 (48 per cent) had a history of previous heart disease. These conditions were not considered contraindications to operation.

The surgical procedure consisted of excision of the aneurysm with end-to-end anastomosis in 14 cases (15 per cent), excision with arterial graft replacement in

61 cases (70 per cent), and by-pass grafting in 12 cases (14 per cent). Primary amputation was deemed advisable in 1 case because of advanced gangrene of the extremity. Homografts, braided Nylon (Edwards-Tapp) tubes, and flexible knitted Dacron tubes were used as replacement material to restore the distal blood flow. Flexible knitted Dacron has proved to be the most satisfactory material.

Despite the high incidence of associated diseases and the frequency of complications leading to arterial occlusion, the results of operation were good. In 78 of the 88 cases of aneurysm (90 per cent), the patient survived, circulation was restored, and amputation was prevented. It is noteworthy that all of a group of 41 patients with early manifestations of the disease, treated before the onset of arterial occlusion, survived. Circulation was restored in all 41 cases; however, in 1 a wound infection necessitated removal of the graft, resulting in gangrene and subsequent amputation.

A recent follow-up of all 72 cases treated during the past eight years shows that the good results have been maintained. Amputation has not been required in any patient since discharge from the hospital. Despite the high incidence of associated diseases, only 8 patients have died since discharge, indicating that this form of therapy for peripheral aneurysm is more than palliative.

REFERENCES

1. Linton, R. R.: The arteriosclerotic popliteal aneurysm, *Surgery* **26:** 41–58, 1949.
2. Gifford, R. W., Jr.; Hines, E. A., Jr., and Janes, J. M.: An analysis and follow-up study of 100 popliteal aneurysms, *Surgery* **33:** 284–293, 1953.
3. Austin, D. J., and Thompson, J. E.: Excision and arterial grafting in the surgical management of popliteal aneurysms, *South. M. J.* **51:** 43–48, 1958.
4. Crawford, E. S.; DeBakey, M. E., and Cooley, D. A.: Surgical considerations of peripheral arterial aneurysms, *A.M.A. Arch. Surg.* **78:** 226–238, 1959.
5. Julian, O. C.; Dye, W. S.; Javid, H., and Grove, W. J.: The use of vessel grafts in the treatment of popliteal aneurysms, *Surgery* **38:** 970–980, 1955.
6. Enderlen, E.: Ein Beitrag zur idealen Operation des arteriellen Aneurysma, *Deutsche med. Wchnschr.* **34:** 1581, 1908.

NUTRITIONAL PROBLEMS AND OPERABILITY IN THE AGED*

WARREN H. COLE, M.D.† AND WILLIAM H. HARRIDGE, M.D.‡

Department of Surgery, University of Illinois College of Medicine, Chicago, Illinois

During the past ten or fifteen years surgeons have become much more aware of the indications and limitations for major operations in aged patients. During this period results have also improved, particularly the operative mortality rate. However, results are still far from ideal. Accordingly, intense study should be devoted to the problems presented by aged surgical patients.

One of the important lessons we have learned in surgical care of the aged is the fact that these patients will tolerate the average major operation about as well as younger patients if there are no complications, but they will not tolerate the extremely serious operation as well, even though no deficiencies are present. Therefore, we should continue to study geriatric surgical problems, particularly since the incidence of operations in patients in this age group will gradually increase from year to year, largely because people are living longer. Moreover, in association with aging, there will be an increase in the more serious diseases such as cancer.

One of the most common and most serious decrements encountered in surgical patients is malnutrition, a condition that will jeopardize the operative mortality rate in any group of patients (especially the aged) if it is not corrected. As a matter of fact, correction of this decrement accounts for most of the improvements in the operative mortality rate during the past three or four decades. Correct use of blood transfusions is another important explanation for the improved operative mortality figures. However, three or four decades ago, blood transfusions were being used, whereas practically no attention was paid to correction of malnutrition before operation. For this reason, more attention must be paid to the correction of malnutrition in the geriatric patient.

CAUSES OF MALNUTRITION

Fortunately malnutrition can usually be detected in surgical patients by the use of two simple questions related to loss of weight and decrease in caloric intake. If the patient has not weighed himself recently, answers to questions concerning the amount and type of food consumed will furnish a fairly accurate index of the degree of malnutrition present.

Gastro-intestinal lesions

One of the most common causes of malnutrition in surgical patients is a gastro-intestinal lesion. Malignant disease is among the most frequent of these

* Presented at the 17th Annual Meeting, The American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Professor and Head, Department of Surgery, University of Illinois College of Medicine, Chicago, Illinois.

‡ Clinical Assistant Professor of Surgery, University of Illinois College of Medicine, Chicago, Illinois, and Associate Attending Surgeon, St. Francis Hospital, Evanston, Illinois.

lesions, and is manifest either as an ulcerating mass within the intestine or as a neoplasm of some other abdominal organ (*e.g.*, carcinoma of the pancreas or liver). The malnutrition may be produced by so many different mechanisms that these will be discussed separately:

Pain in almost any part of the body results in malnutrition because pain reduces the appetite. This, in turn, results in decreased caloric intake. Pain in the oral cavity is a leading cause of decreased caloric intake, because the aggravation of pain produced by eating leads to refusal of food. Abdominal pain, because of its frequent association with nausea and vomiting, is also a major cause of reduced caloric intake.

Inadequate dentures. This deficiency is an important cause of malnutrition in elderly patients, especially if their financial status is low. At the Illinois Research Hospital, which admits charity patients only, this complication is observed with extreme frequency. Unfortunately, the indication for operation is usually so acute that there is no time for correction of the dental deficiency. Time and time again our patients tell us that they cannot eat essential foods such as meat (which is so valuable in correcting hypoproteinemia) because they have only a few teeth and cannot afford to purchase proper artificial dentures.

Enteric fistula. Either an internal or external fistula may give rise to serious nutritional deficiency. Internal fistulae, with few exceptions, are caused by a disease process (*e.g.*, regional enteritis). Under such circumstances, food may be shunted from such a large portion of the intestinal tract that adequate absorption is not possible. External fistulae are usually caused by some type of operative procedure, intentional or otherwise. If the external fistula is colonic (and even if complete), it will not result in malnutrition. If it is in the small bowel, the degree of malnutrition through loss of intestinal content will be dependent upon the amount of small bowel intervening between the duodenum and fistula. Under most circumstances a complete external fistula, with less than 3 or 4 feet of small bowel remaining, will result in malnutrition unless intravenous or forced oral feeding is instituted.

Chronic diarrhea. Any disease which results in diarrhea of more than temporary duration will result in malnutrition; for example, the diarrhea associated with ulcerative colitis. In certain areas of the country amebic dysentery is fairly common. Practically every patient with chronic diarrhea should have two or more stool examinations for ameba and other parasites, even though another cause of the diarrhea has been established, because two lesions may be present, and the penalty for missing the diagnosis of amebiasis is heavy. Chronic obstruction may produce diarrhea. Ulcers of the mucosa intensify malnutrition because of loss of blood from the ulcerated surface.

Ulcers

Gastro-intestinal ulcers have already been discussed. Large cutaneous ulcers cause malnutrition of the hypoproteinemic type, due to loss of blood. The etiologic factor involved in the ulcer is not related to the nutritional depletion except as it is related to the degree of plasma loss, infection or other associated symptoms.

Uncontrolled diabetes

This complication is not uncommon, as a large proportion of patients with diabetes first have their attention called to the possibility of diabetes by an unexplained loss of weight. After institution of insulin and dietary care, significant nutritional imbalance is seldom encountered except when chronic infection or some other factor increasing the intensity of the diabetes intervenes.

Renal disease

Loss of protein by way of the urine occurs in most renal diseases, but this loss seldom results in significant malnutrition. An exception is the nephrosis of childhood, which usually is associated with the loss of large quantities of protein. Because of other manifestations, such as edema, the diagnosis is usually evident early in the disease; nevertheless it may be difficult to correct the loss.

Liver disease

Since a large portion of the proteins are made by the liver, disease of this organ may result in deficient formation of protein and consequent hypoproteinemia. Occasionally, hepatic disease is severe enough to cause a disturbance of carbohydrate metabolism.

Burns

In acute burns there is a marked shift of plasma into and beneath the burned area, whereas in chronic third degree burns there is loss of plasma to the exterior through the resultant ulcer. An acute burn rarely causes true malnutrition, but if the ulceration extends over a large portion of the body and is not covered early with skin grafts, severe hypoproteinemia may develop, with loss of weight. Elderly patients do not tolerate this complication well.

Trauma

In any serious injury there is extravasation of blood into the injured area. Elderly people tolerate the lowered blood volume very poorly owing to inelasticity of the blood vessels and other physiologic decrements. Therefore, in injured aged patients, blood loss should be replaced much more accurately than in young patients.

Transudates and exudates

Either of these complications will result in malnutrition, particularly the hypoproteinemic type. More protein is lost by way of exudates than by way of transudates. Loss of fluid into the various body cavities is usually associated with other manifestations which add to the malnutrition because of anorexia.

Lack of knowledge regarding amounts and types of food

In elderly people, the appetite is almost always diminished, but they rarely realize the change because it has taken place so gradually. The appetite is often abnormal, in that nutritious foods are avoided, but more often the patient is

TABLE 1

Physiologic Evidence of Aging

1. Decreased hormone output
2. Decreased cardiac reserve
3. Decreased vascular elasticity
4. Decreased blood supply to the brain
5. Osteoporosis
6. Decreased blood volume
7. Decreased muscular power
8. Immunologic changes (more resistance to certain bacteria and less to others; decreased resistance to cancer)

simply not aware of their importance. Proper explanation by the physician or dietitian usually corrects the situation. If the manifestations of disease prevent restoration of an adequate intake, intravenous feeding is necessary.

PHYSIOLOGIC DIFFERENCES BETWEEN THE YOUNG AND THE AGED

Although many of the differences in physiology between the young and the aged are well known (Table 1), we are still woefully ignorant regarding other differences. One of the important characteristics of aging is thickening of the arterioles, with loss of elasticity. This pathologic change explains why aged people have such poor tolerance of blood loss, injury, and many other conditions. For this reason, they are more susceptible to the ill effects of hypoxia. There is a decrease in the blood supply to the brain, caused largely by the arteriolar thickening; this reduces mental capacity and has a bearing on the effects of anesthesia as well as the reaction to hypoxia. The decrease in the secretion of sex hormones with aging also influences body resistance; in the male the decrease results in a tendency toward a negative nitrogen balance during periods of disease. Blood volume is usually reduced in the aged, making them more susceptible to the ill effects of blood loss. Cardiac reserve is impaired—a serious situation in the presence of coronary disease. If there has been a recent infarction, operation will not be tolerated. Although immunologic resistance to certain infections is increased in the aged, resistance to most infections is decreased—at least, serious infection in operative wounds is more common in aged patients than in young ones. Muscular power decreases with aging, but it cannot be stated definitely that this decrement decreases operability. The functions of many organs such as the adrenal seem to be reduced in the elderly. As Bortz (1) has emphasized, there is great need for intensive research on body function in the aged.

METHODS OF CORRECTING MALNUTRITION

In most elderly patients with serious lesions, such as cancer, there is a history of weight loss varying from 5 to 30 pounds. If the weight loss is more than 10 pounds, some of this loss must be regained before operation can be performed safely. The necessity for this type of therapy should be strongly emphasized,

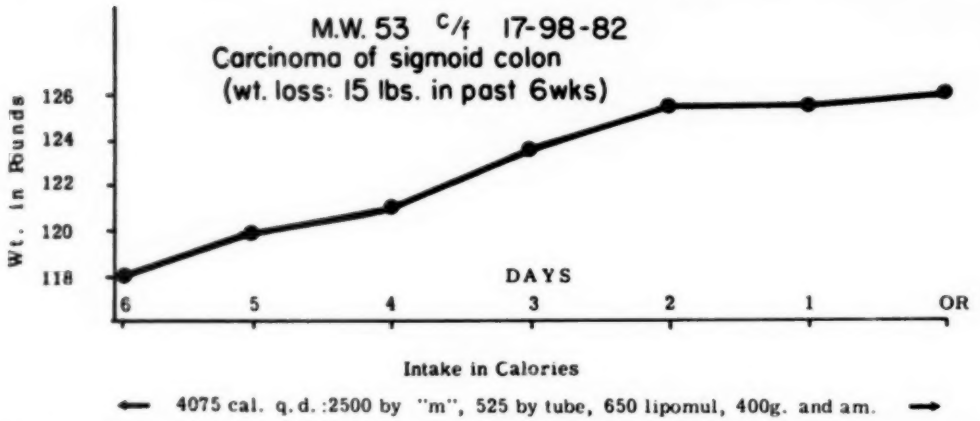


FIG. 1. This patient had a carcinoma of the sigmoid and had lost 15 pounds during the previous six weeks. By a combination of oral and tube feeding with Lipomul, glucose and amino acids, the patient was given an average of 4075 calories per day for six days. There was a weight gain of 7 pounds in six days. Two transfusions were given to correct mild anemia. This therapy resulted in marked improvement in operability.

as correction of malnutrition apparently explains the sharp reduction in surgical mortality rates compared with those of two or three decades ago.

The patient can sometimes be encouraged to eat enough food by mouth to regain a significant amount of weight. However, if he has an ulcerating lesion in the gastro-intestinal tract, oral feeding alone will rarely be successful in achieving a gain in weight.

When the patient is unable to eat enough food to gain about 5 pounds in five or six days, it is necessary to resort to intravenous feeding. If from 800 to 900 calories can be taken by mouth, it is often possible to administer an equal amount at night by drip feeding through a soft plastic tube leading into the stomach through the nose. By administering 1000 ml. of 5 or 10 per cent glucose, 1000 ml. of 10 per cent carbohydrate and amino acids, and 500 ml. of Lipomul (fat emulsion, 800 calories per 500 ml.), from 1500 to 1800 calories can be supplied per day in addition to the oral intake. Both intravenous and oral intakes may amount to 3500 calories daily, resulting in a sharp gain in weight (2, 3) (Fig. 1).

In cases of cancer being prepared for operation there is urgent necessity for correction of the malnutrition within four or five days rather than four or five weeks, in order to minimize the danger of dissemination of cancer cells. For this reason, the repletion program must be an active one.

We have previously (4) reported that administration of cortisone and ACTH for four or five days preoperatively is of great value for improving operability in debilitated aged patients. Extreme anorexia, listlessness and malaise can often by completely overcome. However, it should be emphasized that improvement of this degree does not occur in all the patients so treated.

ADDED PRECAUTIONS IN PREOPERATIVE AND POSTOPERATIVE CARE

Since it is well known that elderly patients undergoing operation tolerate complications and emergency conditions poorly, every effort should be made to

detect and treat complications. Consultation by specialists should be utilized generously (5). Routine blood and urine examinations reveal some of the more obvious complications, such as anemia. In patients with a history of weight loss, the blood protein level should be determined to see whether or not there is hypoproteinemia. Even when the blood protein level is normal, a patient who has lost weight may be treated as if hypoproteinemia were present. The blood protein level may be normal while the protein content of some of the major organs is being depleted. The concentration of nonprotein-nitrogen or of blood urea nitrogen should be determined in cases scheduled for a major operation. This is particularly important in elderly men, as prostatic hypertrophy is so common and may insidiously cause renal damage.

If the liver is enlarged or exhibits other evidence of disease, liver function tests (particularly the bromsulfalein (BSP) test) should be performed. If jaundice is present, the results of the BSP test are worthless. Under these circumstances, the thymol and cephalin flocculation tests should be used because of their value in detecting hepatic insufficiency produced by virus hepatitis (6).

COMPARISON OF OPERATIVE MORTALITY RATES IN PATIENTS OVER 60 WITH THOSE IN PATIENTS UNDER 60

The present study includes an analysis of mortality rates following major operations on 10,844 patients observed during two periods: 1948–1952 and 1955–1959.

TABLE 2

Mortality Rates in Major Operations of Minor Character. Comparison of Results in Patients Under 60 with Those in Patients Over 60 (9-Year Period, Illinois Research Hospital)

Operation	Under 60		Over 60	
	No. of Patients	Mortality (%)	No. of Patients	Mortality (%)
Herniorrhaphy	1043	0.28	373	0.22
Thyroidectomy	714	0.5	246	0.4
Cholecystectomy	483	1.0	165	3.6

TABLE 3

Mortality Rates in Major Operations of More Serious Degree. Comparison of Results in Patients under 60 with Those in Patients over 60 (Indigent Patients)

Operation	Under 60		Over 60	
	No. of Patients	Mortality (%)	No. of Patients	Mortality (%)
Rectum (radical resection)	120	0.8	134	9.7
Lobectomy (lung)	221	2.6	58	10.0
Pneumonectomy	116	8.6	73	20.5
Oral and neck (radical)	212	2.3	244	11.0
Nephrectomy	95	2.1	30	10.0

TABLE 4

Summary of Mortality Rates Following Major Operations in Illinois Research Hospital (9-Year Period)

Age of Patient	No. of Cases	No. of Deaths	Mortality Rate (%)
Under 60 years	7,331	261	3.5
Over 60 years	3,513	264	7.5
Total	10,844	525	4.8

In this study, herniorrhaphy was included among the major operations. As shown in Table 2, the mortality rates following herniorrhaphy and following thyroidectomy were the same both in patients over 60 and in patients under 60. The mortality rate for cholecystectomy was higher in patients over 60 years of age than in those under 60.

A few of the patients in the cholecystectomy series had only mild symptoms; still fewer had gallstones and no symptoms. We have adopted the policy of removing gallstones (along with the gallbladder) in the absence of symptoms, provided the patient has at least eight or nine years of life expectancy. This is done in order to prevent the complications of gallbladder disease, which are tolerated so poorly by the aged, as emphasized by Strohl and Diffenbaugh (7) and many others (8, 9). Some complications, such as perforation of the gallbladder, may develop in elderly people with minimal physical signs. Under such circumstances, bile peritonitis may be far advanced before the patient comes to the attention of the doctor.

Table 3 shows the mortality rates following some of the more serious operations. It will be noted that in association with many of the extensive operations, the mortality rate in patients over 60 was five to ten times higher than in patients under 60. The mortality rate in 7,331 patients under 60 was 3.5 per cent, but in 3,513 patients over 60 it was 7.5 per cent (Table 4). In addition to the operations listed in Tables 2 and 3, this group included all of the common operations (*e.g.*, gastrectomy and colectomy).

Numerous authors have called attention to the high mortality rate following emergency operations in aged persons, compared with the mortality following elective operations. In a series reported by Estes (10), the mortality rate in elective operations was 5 per cent, whereas in emergency operations it was 16.4 per cent. In another series reported by Haug and Dale (11), the mortality rate was 5.7 per cent in elective operations, but 21.9 per cent in emergency operations. In a series reported by Bosch and associates (12), the mortality rate was 8.8 per cent in the elective group and 17.4 per cent in the emergency group. This is a strong indication for the performance of elective operations in elderly people, to prevent emergency conditions which might develop later. For this reason, delay in performing a cholecystectomy in a patient with mild symptoms is more excusable in the younger patient than in the older one.

TABLE 5

Age of Patients Undergoing Major Operations, Including Herniorrhaphies

Period	Over 60		Under 60	
	No. of Patients	%	No. of Patients	%
1948–52	1,099	30.1	2,557	69.9
1955–59	2,414	33.6	4,774	66.4
Total	3,513	32.4	7,331	67.3

Total number of operations in both periods = 10,844.
Percentage of patients over 60 increased 0.5% each year.

TABLE 6

Age of Patients Undergoing Major Operations, Excluding Herniorrhaphies

Period	Over 60		Under 60	
	No. of Patients	%	No. of Patients	%
1948–52	1,031	31.4	2,244	68.6
1955–59	2,031	35.3	3,731	64.7
Total	3,062	33.9	5,975	66.1

Total number of operations in both periods = 9,037.
Percentage of patients over 60 increased 0.56% each year.

In extensive operations upon debilitated elderly patients it is often advantageous (with a resultant decrease in the mortality rate) to resort to modifying the procedure or performing it in stages (13). However, it should be stressed that performing one of the less serious operations in stages may actually increase the risk to the patient, as two mortality rates are involved instead of one.

THE AGE OF PATIENTS UNDERGOING MAJOR OPERATIONS

In our study of operative mortality rates the observations extend over two periods, namely, 1948–1952 and 1955–1959. In the earlier period, 30.1 per cent of the patients undergoing major operations including herniorrhaphy were over 60 years of age. In the later period, 33.6 per cent of such patients were over 60 (Table 5). The patients undergoing herniorrhaphy were, on the average, younger than those having major operations. When herniorrhaphy was excluded from the list (Table 6), 31.4 per cent of the patients in the early group (1948–1952) were over 60 years of age, and 35.3 per cent of the patients in the later group (1955–1959) were over 60. In this group, the proportion of patients over 60 years of age increased 0.56 per cent each year during the seven intervening years.

SUMMARY

Malnutrition is perhaps the most important deficiency observed in surgical patients, especially the aged group. Regardless of age, it must be corrected before operation if an optimum mortality rate is to be expected.

In our series, the mortality rate following major operations such as herniorrhaphy and thyroidectomy was the same in patients under 60 and in patients over 60. However, following the more serious operations, the mortality rate in the older group was two to ten times as high as in the younger group.

Since elderly patients tolerate complications and emergencies so poorly, all complications should be detected and eliminated as far as possible before operation. The indications for performing elective operations in the elderly are usually greater than in younger patients, particularly if the elective operation will prevent the later development of a condition requiring emergency surgery.

Of the patients undergoing major operations (excluding herniorrhaphy) during the period 1948–1952, 31.4 per cent were over 60 years of age compared to 35.3 per cent in the period 1955–1959. This indicates that the percentage of patients over 60 among those undergoing major operations increased by 0.56 per cent per year during the intervening seven years. The total number of operations in the two series was 10,844.

REFERENCES

1. Bortz, E. L.: Mechanism of aging, *J. Am. Geriatrics Soc.* **7:** 835, 1959.
2. Harridge, W. H., and Cole, W. H.: Methods for improving operability in the aged, *J. Am. Geriatrics Soc.* **8:** 79, 1960.
3. Schneewind, J. H.: Intensive preoperative therapy, *Surgery* **44:** 424, 1958.
4. Cole, W. H.; Grove, W. J., and Montgomery, M. M.: Use of ACTH and cortisone in surgery, *Ann. Surg.* **137:** 718, 1953.
5. Stewart, S. K., and Hamilton, H. H.: Management of the elderly surgical patient—A multiple responsibility, *J. Am. Geriatrics Soc.* **8:** 298, 1960.
6. Cole, W. H.: Operability in the young and aged, *Ann. Surg.* **138:** 145, 1953.
7. Strohl, E. L., and Diffenbaugh, W. G.: Biliary tract surgery in the aged patient, *Surg., & Gynec. Obst.* **97:** 467, 1953.
8. Glenn, F., and Hays, D. M.: The age factor in the mortality rate of patients undergoing surgery of the biliary tract, *Surg., Gynec. & Obst.* **100:** 11, 1955.
9. Horwitz, A.: Gallbladder disease in the aged, *J. A. M. A.* **161:** 1119, 1956:
10. Estes, W. L.: Reduction of mortality in surgery of the aged, *Pennsylvania M. J.* **52:** 937, 1949.
11. Haug, C. A., and Dale, W. A.: Major surgery in old people, *A.M.A. Arch. Surg.* **64:** 421, 1952.
12. Bosch, D. T.; Islani, A.; Tarr, C. T. C., and Beling, C. A.: The elderly surgical patient, *A.M.A. Arch. Surg.* **64:** 269, 1952.
13. Jemerin, E. E.: Serious surgery in the aged, *J. Am. Geriatrics Soc.* **8:** 185, 1960.

KEEP THE AGED HEALTHY.

The Prevention of Certain Chronic Illnesses in the Aged*

CHARLES L. WILBAR, Jr., M.D.†

Harrisburg, Pennsylvania

Your invitation to a public health officer—even one who was formerly a pediatrician—to address this meeting may not be untimely. There is unquestionably a rapidly accelerating public as well as professional interest in problems of the aging. This is manifested in the themes of a number of national meetings in the health and welfare field. For instance, in March of this year the annual meeting of the National Health Council was given over to the subject of "Positive Health for Older People." In September 1958, Congress passed an act providing for a White House Conference on Aging in January 1961. The American Medical Association's Committee on Aging has been a committee of unusual activity and has included among its publications "Medicine's Blueprint for the New Era of Aging." Many health and welfare organizations have devoted annual and special meetings to problems of the aging. It would not be surprising if the American Academy of Pediatrics focused some attention on this subject, as major factors concerned with aging begin at birth.

Most of you are familiar with the significant demographic statistics concerning the problems of aging in this country. Let me, however, present a few which are of vital interest from a public health standpoint (1). For young men entering the labor forces at present, the expectation of reaching the normal retirement age is about 68 in 100. More than 70 per cent of men in their late thirties and early forties (at the height of earning capacity and economic responsibility) can, under present circumstances, expect to be alive at age 65. Women fare much better. At present about 83 per cent of women who reach their early twenties can look forward to reaching at least their sixty-fifth birthday. For all persons who reach 65 years of age, 20 per cent of the men and 30 per cent of the women can expect to live to 85. Thus people today, and even moreso in the future, need to plan for a considerable period of life beyond their present working age.

Due to improved immunization procedures, improved sanitation and improved treatment by drugs, surgery and other procedures, mortality from infectious diseases has been astonishingly reduced in the past several decades. Some progress has also been made in controlling certain of the chronic diseases, such as diabetes and pernicious anemia. However, a recent survey in Baltimore showed that among persons who were 65 years of age or older, only 1 in 22 was free of chronic disease. In only 1 of 7 persons in this age group was the chronic disease mild enough not to restrict daily activities or require appreciable medical care. About three-fifths of these persons had some type of heart disease, and

* Presented at the 17th Annual Meeting, The American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Secretary of Health, Commonwealth of Pennsylvania.

more than half had arthritis. Other leading chronic disorders were obesity, hernia, hypertension without cardiac involvement, arteriosclerosis, varicose veins, hemorrhoids and diseases of the genital organs. The prevalence of these conditions was several times as high among persons of this age group as among those aged 35 to 64.

Is all this ill health necessary in the aging? Are older people living to their maximum potentiality regarding life span and healthfulness? The answer to these questions is obviously "No."

RESEARCH

Our knowledge of how to prevent and treat many of the chronic diseases is not nearly as adequate as our knowledge regarding most of the infectious diseases. Much research in preventive medicine has been successful in recent years but much remains to be done. In an article in the March 5, 1960 issue of the *Journal of the American Medical Association* (2), Francis pointed out some of the important research discoveries in preventive medicine in recent years, such as the development of vaccines against influenza and Q fever, and the results of the intensive studies on the ecology of Coccidioides immitis and of the study by the Commission on Accidental Trauma leading to "an effective front of research into the problem of vehicular accidents especially."

In spite of certain advances in research in preventive medicine, most of which have been in the area of infectious disease, there are still tremendous challenges which have been inadequately approached. These deal mainly with the chronic diseases.

As Francis (2) has stated, "with the exception of certain infectious, toxic, or deficiency diseases, so-called therapuetic procedures do not commonly result in cures, for by the time the manifestations are recognized thd defect is well advanced and not ordinarily reversible." To some degree, this can be said of diabetes, cardiovascular diseases, arthritis, mental disorders, neurologic disorders, and a number of the allergic disorders. Such a situation calls for research in what might be termed preclinical medicine. There is need to determine the cause of susceptibility and the cause of breakdown of the natural protective mechanisms of the body against these diseases. When these basic facts are known, better and more effective procedures of prevention can be developed. Looking over published lists of research projects, one is struck by the relative paucity of research in the field of preventive medicine. Yet the results here can be of far-reaching significance and can help us to raise our standards of maximal health.

NEED FOR APPLICATION OF PRESENT KNOWLEDGE

While the need for research is being stressed, there is also need to point out the widespread lack of application of much of the present day knowledge possessed by physicians and other health scientists regarding the prevention of ill health, the proper management of convalescence, and the ability to live happily and usefully with a moderate amount of chronic illness. For instance, the 3 leading identified causes of blindness in the United States are 1) senile cataracts, with a rate of 35.0 per 100,000 population, 2) glaucoma with a rate of 26.7, and

3) diabetes with a rate of 16.6. Blindness from any of these 3 conditions is largely preventable, yet adequate preventive measures are not being satisfactorily applied throughout the population.

Medical science knows how to get rid of tuberculosis, yet tuberculosis is still a widespread and costly disease, causing far too many deaths annually in our nation. The statistical supplement of the annual report of the Pennsylvania Department of Health for 1958 shows that there were 1,016 deaths from tuberculosis in the state that year. There were over 6,000 newly reported cases, and hospitalization alone for tuberculosis in the state cost something over $10,000,000. Tuberculosis is fast becoming a disease of older people. The average age of men at the time of admission to our sanatoria is 50 years. Yet between 50 and 60 per cent of the cases on admission are in the far advanced stage. This shows that in spite of educational efforts, the older person is not having periodic chest x-ray examinations, which would result in early discovery of the disease, early admission to the sanatorium, and quick cure. Rather, he waits until the disease has advanced to a stage where treatment is difficult, and the infection has likely been spread to other people.

Diabetes and cancer can be regarded as "50 per cent" diseases. Our demographers tell us that they are being treated properly in only 50 per cent of persons having these diseases in a treatable form. Several community studies throughout the country have shown that only about half of the cases of diabetes have been diagnosed and placed under proper treatment; yet such treatment enables diabetics to live long, happy and useful lives without severe complications of the disease. Certain types of cancer are not curable with present-day therapy; nevertheless, according to the estimates of the American Cancer Society, half of the cancer deaths need not occur if the victims would seek treatment from a qualified source upon the appearance of early symptoms of the disease.

Even in the field of the diversified cause of injury and death known as accidents, a tremendous amount of preventive knowledge is not being used. Accidents constitute the fourth greatest cause of death in the nation, and in most states constitute the leading cause of death in persons aged 1 to 35. Careful analysis of accident data plus concentrated teaching of preventive measures in certain communities in Michigan resulted in an astounding reduction in accident morbidity and mortality, reducing the accident rate to a fifth of that previous to the educational campaign.

The foregoing are some outstanding examples of the considerable gap between scientific knowledge and popular application of that knowledge in the field of preventive medicine and public health, for conditions significant to our aging population. Many other examples of practical application pertain to pediatrics, *e.g.*, adequate concentration of the fluoride ion in the water ingested by children, and proper measures in school and in the doctors' offices to prevent rheumatic heart disease. In adults there is the decrease in atherosclerosis and arteriosclerosis that follows reduction of weight to levels appreciably below the present average standards; there are also some newly recommended measures which have yet to be firmly established.

In dealing with problems of an aging population, the seeking of new methods

of treatment and rehabilitation as well as accelerated research into the causes and prevention of chronic diseases are essential. However, the greatest challenge may lie in adequate widespread application of the methods already known to modern medicine concerning how to keep well, how to prolong life, and how to maintain maximum physical and mental well-being. The regional office for Europe of the World Health Organization met in July and August of 1958 on the subject of "The Public Health Aspects of the Aging of the Population." A significant conclusion of this meeting was "In order fully to appreciate these problems (the health needs of an aging population) it is necessary to understand the attitudes of old people to them, and their motivation" (3). In my training as a pediatrician I can remember my teachers frequently repeating the statement that "the child is not a little adult." Perhaps we need to repeat frequently that the oldster is not an older young adult. Outlook on life, motivation, reaction to stimuli and judgmental response vary considerably at age 20 compared to age 70. In public health education practices we are constantly finding this to be true, although it does not seem to be realized by all those participating in such programs.

METHODS FOR APPLYING KNOWLEDGE

How, then, can we overcome this lack of widespread application of present-day scientific knowledge regarding preventive measures? How can we close the gap? How can we popularize the medically known, not-too-difficult procedures needed to maintain well-being? We have some advantages that our forefathers did not have. We have more and better-trained minds than at any time in the history of mankind. We have improved tools with which to work—in the operating room, in the laboratory and at the bedside. Best of all, perhaps, we have greatly improved means of communication— the microphone, radio, television, motion pictures, rapid printing, and travel facilities which allow an authority to speak one evening in Boston and the next evening in San Francisco.

Schools

Persons working exclusively in the field of human behavior find that the customs of living and patterns of thinking and behavior among older people are very difficult to change. Therefore, if we are to instill knowledge and desire concerning the practice of modern preventive measures among our citizens, we must start our educational processes earlier in life. Educators tell us that principles learned in the early years of schooling are apt to remain with the pupils throughout their lives. Thus, the primary area for attacking this problem is in childhood, through the regular classroom teaching in our schools. Basic matters of health education, learned in the school in the proper fashion, tend to be life-long guides. What the child learns in school is also apt to influence his parents. In our schools, is there adequate teaching of the basic fundamentals of how to keep well? We do not have sufficient data to provide a definitive answer to this question, but a number of studies in various parts of the nation indicate that health education in our schools is far from what it should be. Several universities and teachers' colleges give little or no health instruction to the prospective

teachers in training. Yet these students, after graduation, are expected to teach basic health practices in their classrooms. Scattered investigations of health textbooks used in the schools in various parts of the country have shown that in many instances the texts are woefully out of date and that anachronistic information is thus being imparted to many of our children. Moreover, some educators think that "health and hygiene" is not a basic subject and should, therefore, be taught mainly at home rather than in the schools. If we are to teach our children how best to live in this modern world, it would seem that fundamental health principles should be included. Before Thanksgiving in 1954, a Gallup poll report stated, "Here is what . . . Americans as individuals say they are most thankful for. Good health, being alive: 57 per cent; good jobs: 16 per cent; family, children: 13 per cent; peace, end of war: 7 per cent." If good health is the condition most desired by Americans, then why should not the basic principles of how to keep well be taught in our schools? It will take a great deal of doing to bring this about throughout the country, but it is so fundamentally important to the future health of our nation as to demand our best efforts.

Health departments

In a health department we spend considerable time in health education. In fact, public health practice is concerned mostly with education and to a relatively small degree with law enforcement. The conditions which are attacking the health of our people today, *i.e.*, the chronic diseases rather than the acute communicable diseases of the past, are of such a nature that adequate preventive measures for the adult must be taught on a person-to-person basis. Health departments use a sort of shotgun education procedure, including news releases, television and radio talks, direct talks to audiences, publication of pamphlets and brochures, and display of posters and exhibits. Although this is beneficial, it is not as effective as direct person-to-person education properly provided by well informed health scientists to laymen. Public health nurses, sanitarians, and other public health personnel do yeomen's work in this regard; however, they are relatively few, and they reach a relatively small proportion of the population.

Physicians

Nearly every citizen, however, visits a physician from time to time. True, he generally goes to the physician for treatment of an ailment, but each of these visits gives the physician an opportunity for intimate and effective education in the principles of prevention of illness and the maintenance of health. If we are to have anything resembling adequate application of health knowledge among our population, this knowledge must be disseminated to a large degree by the practicing physician. Even teaching in the schools will not take care of the situation without the aid of the practicing physician. For one thing, people forget many of the things they learn in school. Also, it is difficult to keep up to date, as each year great advances are being made.

If the physician is to be a teacher of preventive medicine, then he must know

the principles of the subject and be interested in them. At one time, public health and preventive medicine had a minor or negligible place in the curriculum of our medical schools. Then in the period just before, during and after World War II there was considerable interest in improving the teaching of the subject and it was stressed more than previously. However, studies of the curricula in the medical schools of this country in recent years have shown an alarming decrease in emphasis on preventive medicine in some instances. Undoubtedly, to the prospective doctor or to the recent medical school graduate, it is more exciting to snatch a patient from death's door or restore him from a state of prostration to a state of health than to teach him how to stay well—a matter that he may not be particularly interested in initially. Yet if we are really concerned about the total health of our population or about the total health of any individual over his whole life span, the teaching of prevention is most essential and most rewarding. In Pennsylvania, the deans of our 6 medical schools have shown interest in improving the teaching of preventive medicine, and the teachers of this subject have met with some of the leading public health officials of the state to discuss the situation. We expect to have such meetings on a periodic basis in the future. The answers are not simple. Preventive aspects of medicine cannot be taught solely in courses labeled preventive medicine or public health, but should be incorporated into most of the teaching throughout the medical school curriculum.

You, as individuals and as an organization, can do much to effectuate this much needed type of education in order to bring about more widespread understanding and application of the known methods for keeping well. You can speak to medical societies and hospital staffs, and you can publish articles on prevention as well as cure. You can get in contact with leading educators at grammar schools, high schools and colleges regarding the teaching of the basic principles of modern health practices to the students, particularly in our teachers' colleges. You can teach principles of prevention to your patients at every opportunity. You can communicate with the deans and others responsible for the curricula in our medical schools in order to be sure that the preventive aspects of medicine are adequately taught to the prospective doctor so that he will include preventive medicine in his practice after graduation.

SUMMARY

There has been rapid awakening and acceleration of professional and public interest in the problems of the aging, as manifested, for example, by the fact that the 1960 annual meeting of the National Health Council was given over to the subject "Positive Health for Older People," that a special White House Conference on Aging is scheduled for January 1961, and that many other health and welfare organizations devote annual and special meetings to this subject. A few of the major statistics showing the trends in this field are quoted.

Although important research discoveries in preventive medicine have taken place in recent years, there is still need for intensive research in the chronic diseases.

Perhaps the greatest challenge is involved in the wide application of our present medical knowledge regarding the maintenance of health and the prevention of progression of chronic diseases. The increased number of trained personnel, the greatly improved equipment, and the excellent means of communication are not being utilized to their maximum potentials. There is great need for much better training in the preventive aspects of health in our professional schools. There is also strong evidence that many of our school children are not being taught the fundamentals of keeping well and that, if taught, the information is often behind the times.

Much of modern and preventive medicine and public health, since it deals to a large degree with chronic diseases, has to be taught to the adult by direct physician-patient education. Thus, every doctor's office should be a center for informing patients about how to keep well.

Geriatricians can help in this educational activity by speaking on the subject to medical societies and hospital staffs, by publishing articles on prevention as well as cure, and by conferring with leading educators and those responsible for the curricula in medical schools regarding the adequate teaching of preventive medicine.

REFERENCES

1. Statistical Bulletin, Metropolitan Life Insurance Company, New York, March 1959.
2. Francis, T., Jr.: Research in preventive medicine, *J. A. M. A.* **172:** 993 (March 5) 1960.
3. Proceedings of the World Health Organization Meeting, France, July and August, 1958.

PLANNING FOR AGING*

JOSEPH H. BUNZEL†

School of Social Work, Richmond Professional Institute, College of William and Mary, Richmond, Virginia

The derivation of a working definition of planning presents unusual difficulties, but it is necessary to limit the field and define the issues. Confusion exists particularly in the field of health, welfare, and social planning. Planning often is identified with Utopian ideas, wishful thinking, and even with the first steps to servitude, yet nothing could be farther from the truth. Planning must not be identified with pious hopes, the listing of desiderata in a given area of human endeavor, or programming.

In the words of McKim Norton[1] and Frederick P. Clark[1], planning "is a method of determining policy under which developments may take place in a balanced, orderly fashion for the best interest of the people of a given area" (1). In a wider sense, A. Howe Todd, Richmond's Director of Planning, thinks of planning as "a process where, because of faith in the ability to influence the future, one uses foresight to achieve predetermined goals" (2). Walter Blucher, as Executive Director of the American Society of Planning Officials, gave his definition of a master plan as "the community's idea of what it wants to be" (1). Translated into the field of aging, such a plan would represent the ideas of our society as to the best environment for aging.

In the words of Henry Hubbard, the late head of the School of Regional Planning at Harvard University, "planning must be comprehensive." That is to say, each item must be considered in its relation to the whole, and planning must not be confused with programming nor with execution, which Hubbard saw as "the translating of designs shown in drawings and words into three-dimensional physical structures, and translating the planned human regulations into judicial decisions and perhaps jail sentences" (1).

Specifically, planning is the expression of interested thinking on a specific problem in order to obtain foreseeable results. The assessment of resources and assignment of priorities precedes and forms the planing process, enabling us to make choices. Making choices is the basic condition of freedom, both for the individual and for society. Thus, planning not only is *not* a restriction of freedom, but is its inseparable and indivisible corollary. Stated more strongly, freedom is impossible without planning.

* Presented at the 17th Annual Meeting of the American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Associate Professor of Social Research.

The opinions expressed in this paper are those of the author and do not necessarily reflect those of the College or its officials. In order to preserve the immediacy of the presentation, only minimal corrections have been made and no scholarly apparatus has been added.

[1] Formerly Executive Vice President and formerly Planning Director, respectively, of the New York Regional Plan Association.

PLANNING FOR AGING

Planning for aging includes, but does not mean exclusively, planning for *the* aging. A difficulty seems to be that the two are closely connected in our minds. All planning is concerned with human life, so that, if we wish to go deeply into the planning process for aging, we must have a theory of time and matter, and expand it through space, duration and action. It is not necessary to dwell upon these philosophical concepts nor to try to prove their existential value. Suffice it to say, that planning as a process for aging properly might start prenatally and continue until death.

In order to make valid assumptions, the social scientist must define his terms—"aging" for instance—and establish criteria for research in order to achieve reliable measurements. It is not sufficient to define age chronologically. It is commonplace among geriatricians and gerontologists that a chronologic definition is inadequate. Because of the infinite variety of human experience and endurance, mere chronology should not be the basis, and certainly not the sole basis, of planning for aging. The basis should be *service*, that is, service rendered to society and received from society, as an heuristic tool for expressing age.

THE SOCIO-PSYCHOLOGIC APPROACH

The socio-psychologic approach, using Lewin's concepts and his field theory as well as operational definitions for a large number of needs of the individual, should be combined with a mathematico-statistical device based on the theory of probability in order to construct a model of reality. The framework might be as follows:

Two continua to be constructed from birth . . to . . death:

(*a*) in one, services rendered by society to the individual might be expressed as 100 . . 75 . . 10 . . 85 . . 0;

(*b*) in the other, services of the individual, that is, his contributions to society, might be expressed as 0 . . 50 . . 85 . . 50 . . 0.

This thinking presupposes the construction of 2 indices—one for services of the individual, and one for services to the individual—and of an equation wherein the need of the individual is a function of the service index with relation to the contribution index. This would call for the careful weighing and scaling of units of service, using sociometric and psychometric methods and findings. If research is to be more than mere fact finding, it must have such creative effort as its basic tool. The construction of a *service age* would be the starting point, or cornerstone, for building.

RESEARCH STUDIES

Without social research, no social planning is possible; and without social planning, no social action can be taken. Making the community and society aware of important social problems is a part of the function of research. Research into large segments of the population in all strata and subgroups of the entire society makes possible the preparation of a master plan.

An interconnected network of research into aging is inevitable. The studies

that may be sponsored, initiated, or executed by commissions or committees on aging are of four major kinds:

Inventory studies. Who are the old? Where do they live? What is the state of their health? How do they participate in the social life of the community? Basic surveys to answer these questions serve to delineate the territory rather than to explore specific pathways.

Sociologic and psychologic studies. These may or may not involve statistical methods. They may be interview studies based upon questionnaires or schedules, case record studies, or hypothesis-seeking field studies.

Monographic studies. These would be of small groups or of individuals, with special emphasis on the socio-psychologic and bio-medical factors in aging in communities and throughout the nation.

Action research and programs. These would be designed to involve communities, and through them society, in changes and growth. They might be instrumental in accelerating or slowing social processes.

These types of research are familiar, but their coordination should be emphasized with the proposal that commissions and committees planning for the aged, in conjunction with state gerontologic institutes, should carry out such research.

AGENCIES

State commissions and committees. We surveyed state commissions and committees on aging in order to determine: 1) the status, within the states, of legislation concerned with the aged, 2) whether the commission or committee had a program for research or for action, or both, 3) whether the state participated actively in the work of the commission or committee, and 4) whether salaried staff was employed, their numbers, and on what level of employment. The 17 replies showed that a variety of approaches to the work exist. All 17 responding states[2] have legislation with regard to aging—some more, some less. Connecticut, for example, has an anti-discriminatory statute with regard to employing older persons. In two states, no legislation has been passed to establish a commission, but the White House Conference of Aging served as a stimulus to create appropriate bodies even in these.

The two basic kinds of commission are: (a) one with approximately 15 members consisting of 5 department heads, 5 legislators, and 5 citizens, or some combination of these, and (b) one with 50 or more members who divide the work. The answer to the third part of our survey depended upon the kind of commission and the way it worked. Some respondents thought that the presence of department heads indicated state participation. Others based their answers upon whether or not the state participated financially by lending research or other personnel, or in some other way. Five of the 17 answered in the negative.

The programs of the commissions differed widely. Only two had action programs in operation. Four reported that the commission had a research program. One reported an action *and* research program. Two commissions employed no

[2] Grateful appreciation is expressed to the directors and secretaries of the commissions and committees responding to our inquiry.

salaried staff. Only one had a strong executive office with a director, assistant director, two research assistants, an information officer, and semi-professional and clerical staff. Most of the commissions seemed to consider themselves as stimulating clearing houses. The amount of comprehensive planning appeared to be small.

Other agencies. It is not necessary to enumerate all agencies, public, private, federal, state, local and regional that have planning programs for aging, but a few will be named in order to point out the areas of work, health, and social participation.

The focal point for current planning is the White House Conference on Aging. The hearings of the McNamara Subcommittee will be an invaluable resource for future planning as far as the government is concerned, and perhaps also for university and foundation research. The Federal Council on Aging, a cabinet level organization, provides coordinated planning at the highest level. The Special Staff on Aging of the Department of Health, Education, and Welfare is represented on this panel. Programs within this Department include the Social Security Administration and the Public Health Service. There are also programs within the Department of Labor, the Veterans Administration, and others. There is a National Committee on Aging of the Social Welfare Assembly. At the state level, there is the Council of State Governments. Other bodies are the American Medical Association committee, the American Public Welfare Association program, the relatively newly founded American Association of Retired Persons and its affiliate Retired Teachers, the conferences of the University of Michigan, and many others. In addition to these, and labor union, industry, and insurance company programs, there are mayors' and governors' committees, gerontology committees of the community councils, innumerable church, school, and civic planning bodies, the American Geriatrics Society and the Gerontological Society, and the various committees of the county medical societies. The possibilities for cooperation among all of these are limited and duplication of effort hardly is avoidable.

EMPLOYMENT

The flowering of commissions, committees, and groups is not an unmixed curse. In a democratic society, it is hopeful and necessary to have the widest participation of the citizenry in such burning and comprehensive questions as those related to aging. However, it will be helpful to make some guidelines and devote some attention to the area of work. Nearly everyone is informed as to statistics, so we shall take them for granted. A society like ours, based on the ideas of physical prowess and willingness and ability to work, is naturally youth-conscious. It also is work-centered, and, in fact, largely work-conditioned. On the ladder of life, a person is considered according to the rung to which he has climbed by working. Extensive study in universities, often to age 25 or older, makes the period prior to employment longer than ever before. Difficulties beset an older man or woman who has lost his or her place of employment, in regaining the status of a self-employed and, therefore, a self-respecting person. Thus the

period of life in which gainful employment may be sought has grown shorter. With longevity upon us, the period after employment frequently has become unbearably long because of the deprivation of status connected with lack of work, not to speak of the deprivation of income which makes the loss of status even more obvious.

The following semantic remedy is admittedly palliative rather than curative. If we were to divide life consistently into three parts—pre-employment, employment, and post-employment—we could help the aging population considerably. We could dispense with the word "retirement," which etymologically contains the thought of distance from life, and speak only of post-employment. We might also bring to bear new concepts on some real problems with which the older citizen is confronted. One is that Social Security, which incontestably is a right acquired by payments over a period of time, hampers the earning capacity of the person receiving it. The other is that part-time employment is a kind of crutch that diminishes status.

Some interesting parallels exist in our mores concerning work and sex, which, Freudians contend, are the main regulators of life. A young man reaches economic maturity a great deal later than he reaches sexual maturity. This fact may lead to early and often unwise marriages between people of the same age with little or no sexual experience. Although that experience can be obtained, the young man may be beset by feelings of guilt or sin if he is religiously inclined, or by feelings of economic insecurity if he believes in the overwhelmingly middle-class mores of our society. Neither is sexual maturity coincidental with economic security for a young woman who reaches sexual maturity about five years (and many cases seven years or more) before she earns her living or marries. In the last third of life, the same, often subconscious, process takes place. Sexual gratification is relegated to a lesser, sometimes even ludicrous, place; economic gratification often is impossible. We are in an age of transition, and eventually society will make the necessary adjustments, if for no other reason than enlightened self-interest. Meantime, we have to deal with innumerable tragic cases. Help, either semantic or financial, would be most welcome.

HEALTH

Another semantic crutch would be to cease referring to old age as a problem per se. Aging is a process, and such nomenclature as Division of Old Age and Chronic Disease is highly disturbing. It is a pleasure to note that the Public Health Service now has a Division of Special Services. It is to be hoped that other public bodies will do away with the parallelism between chronic disease and old age.

Many diseases are chronic from early youth. Chronicity may, in fact, lead to a long life because the patient preserves his strength better than if he were fully active. Physicians stress that, except for dementia senilis, no disease is definitely connected with old age. However, ill health constitutes a major threat to the older citizen, and "something must be done about it."

One fallacy in planning probably is to predicate studies of older persons upon

studies of others who are 65 years of age and older. It should not be forgotten that those who will be 65 years of age and over, fifteen to twenty years from now, will differ considerably from persons studied during the last fifteen years. Longitudinal studies have often been costly and suffered from small samples. Therefore, it would be simpler to undertake large-scale, cross-sectional studies of persons aged 20, 40, and 60 in order to prepare for the changes which differences in nutrition, psychologic circumstances, and social and economic climates will have brought to bear on the older citizens of tomorrow.

The attachment of health and comprehensive medical care (including dentistry, optometry and prosthetic devices) to the framework of social insurance has many advocates. The numbers of people requiring such care are too large to permit any but the broadest solution. We shall have to plan with this fact in mind. Social insurance today is a basic tenet of the American people. All of the measures described as socialized medicine not only are *not* contemplated but run counter to tradition and outlook, regardless of what administration sits in Washington and of the composition of Congress. Here we have to deal with another semantic trap. If we do not recognize social insurance for what it is, but emotionally take it for what it is *not*—namely, hospitals run by the federal government and with physicians employed by the state—we are missing an excellent opportunity to direct forces which otherwise will overwhelm us. That health insurance for the aged has become a political issue is undeniable and highly regrettable. Wily semantics have misled many people.

SOCIAL PARTICIPATION

Another area for contention in proper planning lies in social participation. Again, it is unwise to speak of leisure time and leisure-time activities. That this does harm to older people was recognized more than ten years ago, but only now has the expression "free time" gained acceptance. Social participation must be planned *with* and not *for* the aging. Our national tendency to change from participants to spectators is not restricted to old age, but there it does the greatest damage.

Study after study has shown that the older person does not wish to be segregated in a community of oldsters, far from his family or friends. He wants to remain independent as long as it is physically possible, to be master of his fate and decisions, and to participate fully in the fate and decisions of his community. If the community is not interested in the opinions and contributions of its senior citizens, re-education of the community is necessary. For us, it is a matter of concern to use suitable public-relations methods in order to obtain full social participation by, and for, the senior citizen. The ways are legion; the literature abounds with them.

PROPOSED PLANNING BODY

One planning tool stands out in my mind—the Gerontological Institute. Dr. Nathan Shock of Baltimore proposed this sometime ago, and it has been put into practice in various places, including the states of Iowa and Connecticut.

Such an institute should be attached to every State university. If the Commission on Aging (or other official body known by a different name) would help to establish the institute and cooperate in its action program, planning for aging could be standardized on a high level of performance, and not be dully imitative or regimented from above.

The institute would have three branches: biologic, medical, and social, with a psychologic undergirding for the whole. It would not only lead in research, but would propose action, help in securing legislation, and make itself the center of work in the field of aging. The institute also could put some of the tools for public relations, which are important from a semantic standpoint, into practice by the use of leaflets, conferences, television programs, and other mass media.

The institute could implement and supplement national and federal planning. Our society is founded on the proposition of the pursuit of happiness. Work, health, and social participation are needed and are indispensable. Some aspects of each of these constitute problems too large and too deep to be solved on any but the broadest—not necessarily the highest—level. Social participation, cutting across cultural and subcultural groups, must be planned with the importance in mind of the concepts outlined.

Through the work of state commissions and committees (particularly after the White House Conference on Aging) in connection with gerontological institutes, we can effect a planning program that affords freedom of choice and safeguards individual freedom by a simultaneous guarantee of societal order. This would go far toward solving one of the basic problems of life in the twentieth century, at least for an ever-growing part of the population.

REFERENCES

1. Vance, J. E.: Report on Metropolitan Planning. Results of a questionnaire sent in August 1947 to outstanding city and regional planners. Distributed by the Civic Planning and Traffic Board, Chamber of Commerce, Providence, R. I.
2. Todd, A. H.: Personal communication.

PSYCHOLOGIC STUDIES IN GERIATRIC HEMIPLEGIA*

EDWARD J. LORENZE, M.D.† RALPH CANCRO, M.A.‡ AND
MARTIN A. SOKOLOFF, PH.D.§

The Burke Foundation, White Plains, N. Y.

The psychologic phenomena associated with the aging process and the superimposed brain damage resulting in hemiplegia are varied and extensive. We have investigated a group of older patients with hemiplegia resulting from cerebrovascular accidents in order to ascertain whether visual perceptual defects (as determined by certain tests) significantly interfere with ambulation or the activities of daily living. There is no lack of evidence of the presence of these defects (1–3).

In a previous study (4), we reviewed the records of 200 consecutive patients admitted with hemiplegia due to cerebrovascular accidents, in order to determine success or failure in terms of ambulation, and to analyze the cause of failure. In the cases of failure, we were particularly interested in determining whether factors other than clearly established defects in neuromuscular function resulting from paresis or spasticity played an important part. Conscious sensory defects, cerebellar disturbances with ataxia, apraxia, and visual perceptual defects were assessed in relation to balance and righting reflexes.

In that study, 116 of the 200 patients (58 per cent) were in the success group, but 52 patients (26 per cent) failed to achieve independent ambulation after participating satisfactorily in a treatment program. Of these total failures, 50 per cent required maximum support, 25 per cent required minimal assistance for support or balance, and 25 per cent required observation for only occasional assistance. Among the causes of failure, muscular disability was the most common, occurring in 32 of the 52 cases; next in order were negative motivation (6 cases), problems of balance in association with satisfactory motor power (4 cases), and cerebellar ataxia (3 cases). There were many instances of visual disturbance, but in only 1 case (homonymous hemianopsia) was it considered to be the cause of ambulatory failure, since the patient could use his muscles to walk, but would run into objects and lose his balance. There were no cases in which visual perceptual changes were the primary cause of failure. Lack of visual perception was considered to be a significant factor in 1 patient who required observation because of lack of judgment but who also manifested extensive organic mental changes with gross intellectual deficit, and in 1 patient who required minimal assistance and who also manifested apraxia with muscular weakness. It should be borne in mind that we used particular criteria for establishing the presence of visual

* Presented at the 17th Annual Meeting, The American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Medical Director, The Burke Foundation; Assistant Professor of Clinical Medicine, Cornell University Medical College.

‡ Chief, Psychological and Vocational Services, The Burke Foundation.

§ Consultant in Speech and Hearing Services, The Burke Foundation.

perceptual changes and that we were determining only the success or failure in ambulation—not whether the presence of these changes, as tested, delayed the achievement of ambulation in the success group.

In that study, we used a series of tests which included the Weigle-Goldstein-Scheerer Color Form Sorting Test, the Goldstein-Scheerer Block Design and Stick Test, and the Visual Agnosia subtest of the Eisenson Test for Aphasia. Although these are tests of abstract thinking, an attempt was made to differentiate cases in which the organization of visual material is distorted while abstract thinking in other areas is not as severely affected. There was no clear evidence in any case that a disturbance of visual perception, *i.e.*, spatial disorientation or figure/ground distortion was the primary cause of failure of independent ambulation.

There was no significant difference between males and females in the incidence of success in ambulation, urologic problems, side of cerebrovascular accident, aphasia, bilateral or multiple involvement, cardiovascular disease, and severe organic brain syndrome (5).

Bruell *et al.* (2) in 1956 noted that hemiplegic patients show greater deviations from normal subjects of the same age group in adjusting a pre-set luminous rod to the vertical position (either counter-clockwise or clockwise). No difference in the type of response was noted between patients with left hemiplegia and those with right hemiplegia. Differentiation depended upon the original position of the rod, and the deviation from true vertical was always on the side of the original pre-set position. This deviation was called a disturbance of space perception, and was believed to indicate that some hemiplegic patients misperceive vertical objects in the environment as tilted. They attempt to align the body with this tilted misperception as a visual cue to the upright position, thus mistakenly leaning to that side and falling. No statement, however, was made as to the relationship of these findings to failure in ambulation or in activities of daily living. Since the hemiplegic patients, regardless of side of paralysis, consistently oriented the bar towards the pre-set position (whether set counter clockwise or clockwise), one wonders why hemiplegics usually fall on the paretic side.

In a second study published in December 1957, Bruell *et al.* (3) found that normal subjects and some hemiplegics were victims of the illusion that, in a dark room, a vertical luminous rod was somewhat tilted when a luminous-edge square background was slightly tilted. This illusion was absent when the background figure was tilted so that it had a vertical axis of symmetry, with the frame forming a diamond. However, some of the hemiplegics who manifested high degrees of deviation from the vertical in the first test, made even greater errors when the square background was tilted diamond-wise. These patients were considered to be totally disoriented in the dark room; they did not realize that the frame had been tilted, and they would turn the luminous rod until it was at right angles with the "top side" of the frame. No difference in response was noted between patients with right hemiplegia and those with left hemiplegia. In this study of 20 hemiplegics, only 1 of 9 patients who achieved the best ambulation was "disoriented," whereas 5 of the 6 patients who walked poorly were "disoriented,"

as were all 5 of the wheelchair patients. As the authors pointed out, it would be difficult to differentiate between nonambulatory and poorly ambulatory groups by this test. It should be noted that the poorly ambulatory patients apparently correspond with the patients we had classified in our previous study as independently ambulatory. For a majority of patients, this would appear to be a satisfactory level of achievement.

Birch *et al.* (6) reported that hemiplegic patients have difficulty in recognizing an object in relationship to the mid-line, as tested by a luminous rod in the dark versus normal illumination. Performance was essentially the same, whether the hemiplegia was left or right. The authors state that the alteration in median perception is not the result of general reduction in intellectual function, as they found higher IQ levels in the patients with left hemiplegia than in those with right hemiplegia. The relationship of this perceptual difficulty to success in ambulation and the activities of daily living was not determined.

In another study, Birch *et al.* (7) demonstrated that hemiplegic patients performed more poorly than normal controls in indicating the vertical and horizontal positions of a luminous rod, although there was no significant difference on the basis of whether the hemiplegia was on the right or on the left. The patients with left hemiplegia made their errors predominantly with regard to the counter-clockwise direction. Apparently a directional rotation of the entire subjective visual field takes place rather than a disruption of Cartesian coordinates.

It has been stated (1) that patients with hemianesthesia and hemianopia may achieve ambulation, but that this adjustment is limited in scope. This is not true in all cases, however. In our series there were no cases of failure attributable to such conscious sensory defects, and there were many cases in which patients achieved successful ambulation in association with such defects, particularly the loss of position sense.

A review of the literature indicates that, although considerable research has been carried on in the area of perceptual disturbances in hemiplegic patients, few attempts have been made to relate these disturbances to the success or failure of ambulation and the ability to perform the activities of daily living (ADL). The purpose of the present study was to ascertain if there was such a relationship.

CLINICAL MATERIAL AND METHODS

Patients

A group of 119 hemiplegic patients was studied for success and failure in ambulation and ADL as related to side of the body that was paralyzed. From this group, a smaller sample of 35 patients was examined for the degree of visual perceptual dysfunction as related to success or failure in ambulation and ADL.

Of the 119 patients, 62 had right hemiplegia and 57 had left hemiplegia. In the right hemiplegia group, there were 18 males and 44 females; in the left hemiplegia group there were 33 males and 24 females. In 35 of the 119 patients, visual perceptual problems were evaluated. The mean age of these 35 patients was 60 years; 17 had right hemiplegia and 18 had left hemiplegia. With the exception of 2 mentally deteriorated patients, all subjects in this sample had a verbal IQ of 85 or above; thus language function and verbal intelligence on the whole, were within normal limits.

Definitions

For the purposes of this study, success in ambulation was defined as ambulation without assistance, even though under observation. Success in activities of daily living (ADL) was measured solely in terms of the independence achieved in gross dressing, feeding and toilet activities.

Perception was defined, according to the concept of Eisenson (8), as "the intellectual process by which meaning is derived from a given stimulus situation. It may be considered the organizational process through which the individual is enabled to understand the significance of what goes on about him."

A visual perceptual defect is present when the organizational process of visual cues is disturbed or distorted. Visual/motor ability is, in large part, a cognitive function which includes depth perception, spatial orientation, manual dexterity and visual perception. Visual perceptual disturbances have been correlated with figure/ground problems, segmentation of the whole, spatial orientation, monitoring of visual clues and/or motor responses (9). If the basis of the visual perceptual difficulty can be determined, then training techniques aimed at amelioration might be feasible.

Procedure

The degree of intellectual deficit or loss is extremely difficult to evaluate accurately unless pre-morbid psychologic test data are available. The patient's occupation may provide a clue to his former level of intellectual function. Since none of our patients in this study had pre-morbid test data, the degree of intellectual loss could not be ascertained in this manner. The alternative method of estimating intellectual loss on the basis of former occupation is fraught with so many hazards that it is not valid for research purposes. In this study we were concerned not with amount of intellectual loss, but with the significant discrepancies between two major areas of cognition, *i.e.*, verbal ability and visual motor performance.

To determine the existence of visual perceptual disturbances not consistent with the patient's overall intellectual level, the following series of tests was administered:

1. Either (a) the Wechsler-Bellevue Intelligence Scale, Form I (10), or (b) the Wechsler Adult Intelligence Scale (11),
2. The Bender Visual Motor Gestalt Test (12),
3. Specific subtests of the Goldstein Tests for Abstract Behavior (13)—Stick Test, Block Designs, Color-Form Sorting Test,
4. Visual Agnosia portions of the Eisenson Test for Aphasia (8).

Within the framework of normal verbal intelligence, a visual perceptual disturbance was considered to be present when the following criteria were met: 1) a verbal IQ at least one standard deviation higher than the performance IQ, when in the opinion of the examiner this difference was not attributable to physical handicap, and 2) a significant subtest scatter in the weighted scores of the performance portion of the test, with a particular decline in the scores of block design, object assembly and picture completion.

The Bender, Eisenson and Goldstein tests were administered when the foregoing criteria were met.

The Wechsler scales were administered and scored according to the standardized procedures. When the patient demonstrated a significant reduction in the weighted score of the block-design subtest of the performance portion of the Wechsler scale, further examination was made using the block design portion of the Goldstein-Scheerer test.

A *mild visual perceptual disturbance* was considered to be present when the decline in the performance score of the Wechsler scale was one standard deviation when compared to the verbal score, and no indication of visual perceptual problems was obtained from the other test data. *A moderate disturbance* represented a discrepancy of more than one but less than two standard deviations between the verbal and performance portions of the Wechsler scale, and also evidence of a defect with the other tests. *A severe disturbance* indicated a discrep-

ancy of more than two standard deviations between the verbal and performance portions of the Wechsler scale, corroborated by other test data.

Lowering of the score for the Wechsler performance subtests (block design, object assembly and picture completion) was considered to be the most reliable indicator of visual perceptual disturbance. Discrepancies may be established by comparing these scores with those for the verbal scale (information, comprehension, similarities and vocabulary). In a group of patients with hemiplegia due to cerebrovascular accident, the scores for the arithmetic and digit-span subtests of the verbal portion correlate best with scores for the performance scale rather than the verbal scale. In the performance scale, the picture arrangement scores correlate best with those for verbal ability as measured by comprehension, similarities, information and vocabulary.

RESULTS

Ambulation

In the total group of 119 cases (Table 1), 75.8 per cent of the patients with right hemiplegia and 66.7 per cent of those with left hemiplegia achieved success in ambulation. There was no significant difference between right and left hemiplegia in terms of successful ambulation. There was, however, a significant difference between these percentages and those obtained in a previous study (5) of 254 hemiplegic patients admitted to The Burke Foundation. In that group, 55 per cent of the patients with right hemiplegia and 55 per cent of those with left hemiplegia attained successful ambulation. When the percentage of success for patients with right hemiplegia in the present study is compared with that in previous study, a significant difference is evident ($P < .01$); however, this does not hold for the patients with left hemiplegia. The higher incidence of successful ambulation in the present study is probably related to the change in our criterion

TABLE 1

Success or Failure in Ambulation and ADL in 119 Patients According to Side of Paralysis

Side of Paralysis	No. of Cases	Percentage of Cases
Right hemiplegia (62 patients; 18 males, 44 females)		
Success in both ambulation and ADL	45	72.6
Failure in both ambulation and ADL	12	19.3
Success in ADL; failure in ambulation	3	4.8
Success in ambulation; failure in ADL	2	3.2
Left hemiplegia (57 patients; 33 males, 24 females)		
Success in both ambulation and ADL	30	52.6
Failure in both ambulation and ADL	17	29.8
Success in ADL; failure in ambulation	2	3.5
Success in ambulation; failure in ADL	8	14.1
Right hemiplegia (62 patients)		
Success in ambulation		75.8
Success in ADL		77.4
Left hemiplegia (57 patients)		
Success in ambulation		66.7
Success in ADL		56.1

for success. In the previous investigation, cases which required observation were considered failures, whereas in this study they were included with the successes.

Activities of daily living (ADL)

Of the 119 patient (Table 1), 77.4 per cent of those with right hemiplegia and 56.1 per cent of those with left hemiplegia were successful in ADL. This difference of 21.3 per cent is very significant ($P < .01$), and suggests that patients with involvement of the dominant (right) hand may be expected to perform more satisfactorily. It has been noted by others (14) that, in terms of employment, patients with right hemiplegia are more successful.

Sex of patient and side of paralysis in relation to success in ambulation and ADL

In Table 2 the data on the 119 patients are summarized on the basis of the sex of the patient and the side of paralysis as related to success in ambulation. In the group of 44 females with right hemiplegia, 75 per cent achieved success in ambulation; in the group of 18 males with right hemiplegia, 78 per cent achieved success. The difference is insignificant statistically. In the group with left hemiplegia, 64 per cent of the males and 71 per cent of the females were successful in ambulation. Here, too, the difference is insignificant.

Table 2 also contains the data on the sex of the patient and the side of paralysis as related to success in the activities of daily living. In the group of 44 females with right hemiplegia, 77.3 per cent achieved success in ADL; in the group of 18 males with right hemiplegia, 77.7 per cent achieved success. In the group with left hemiplegia, 54.5 per cent of the males and 58.3 per cent of the females were successful in ADL. There were no significant differences between males and females with right hemiplegia, nor between males and females with left hemiplegia.

In the group of 35 hemiplegics examined for visual perceptual defects, 100 per cent of those with right hemiplegia and 89 per cent of those with left hemiplegia were successful in ambulation (Table 3). In the activities of daily living, 94 per cent of the patients with right hemiplegia and 72 per cent of those with

TABLE 2

Success or Failure in ADL and Ambulation According to Side of Paralysis and Sex of Patient (119 Cases)

	Success in ADL and Success in Ambulation	Failure in ADL and Failure in Ambulation	Failure in ADL and Success in Ambulation	Success in ADL and Failure in Ambulation	Total
Right hemiplegia					
Males	14	4	0	0	18
Females	31	8	2	3	44
Left hemiplegia					
Males	17	11	4	1	33
Females	13	6	4	1	24
Total	75	29	10	5	119

TABLE 3

Frequency of Success or Failure in Ambulation and ADL According to Side of Paralysis in 35 Patients Examined for Visual Perceptual Defects

	Success in ADL and Success in Ambulation	Failure in ADL and Failure in Ambulation	Failure in ADL and Success in Ambulation	Success in ADL and Failure in Ambulation	Total
Right hemiplegia	16	0	1	0	17
Left hemiplegia	13	2	3	0	18
Totals	29	2	4	0	35

TABLE 4

Severity of Visual Perceptual Dysfunction According to Side of Paralysis in 35 Patients

Visual Perceptual Dysfunction	Left Hemiplegia	Right Hemiplegia	Total
Severe	7	0	7
Moderate	4	9	13
Mild	4	6	10
None	3	0	3
Mental deterioration	0	2	2
Total	18	17	35

left hemiplegia were successful. These percentages were all significantly higher than those for the larger 119-case group, but it was assumed that the results were biased because of the small size of the sample. Therefore no statistical conclusions were drawn.

Visual perceptual dysfunction and success in ambulation and ADL

Within this group of 35 patients (18 with left hemiplegia and 17 with right hemiplegia), 30 showed some degree of visual perceptual dysfunction (Table 4). The defect was severe in 7, moderate in 13, and mild in 10. Of the remaining 5 patients, 3 showed no evidence of visual perceptual disturbance. The other 2 patients were mentally deteriorated and were functioning on a very low intellectual level. In the absence of significant test data regarding the various cognitive functions, these 2 patients could not be classified in any of our categories, although they obviously had severe visual perceptual defects in addition to other gross intellectual deficiencies.

Of the 13 patients with either no visual perceptual defect or only a mild one, there was 100 per cent success in both ambulation and the activities of daily living (Table 5).

Of the 13 patients with moderate visual perceptual dysfunction, 11 achieved success in both ambulation and ADL, and 2 failed in ADL but were successful in ambulation (Table 5).

TABLE 5

Success or Failure in Ambulation and ADL According to Severity of Visual Perceptual Dysfunction in 35 Patients

(18 cases of left hemiplegia; 17 cases of right hemiplegia)

Degree of Visual Perceptual Dysfunction	Success in ADL and Success in Ambulation	Failure in ADL and Failure in Ambulation	Failure in ADL and Success in Ambulation	Success in ADL and Failure in Ambulation	Total
Severe	3	2	2	0	7
Moderate	11	0	2	0	13
Mild	10	0	0	0	10
None	3	0	0	0	3
Mental deterioration	2	0	0	0	2
Total	29	2	4	0	35

Of the 7 patients with severe visual perceptual dysfunction, 3 were successful in ambulation and ADL, 2 failed in both, and 2 failed in ADL only. All 7 patients had left hemiplegia (Table 5).

The 2 mentally deteriorated patients (not classified) were successful in both ADL and ambulation.

When the side of paralysis was considered in relation to the severity of the visual perceptual disturbance, the following distribution was observed (Table 4): *a*) in the 18 cases of left hemiplegia, perceptual defects were severe in 7, moderate in 4, mild in 4, and absent in 3; *b*) in the 17 cases of right hemiplegia, perceptual defects were severe in none, moderate in 9, mild in 6, and present in 2 mentally deteriorated patients.

SUMMARY AND CONCLUSIONS

In a study of 119 cases of hemiplegia, there was no significant difference between patients with right-sided paralysis and those with left-sided paralysis regarding success or failure in achieving independent ambulation.

Regarding the ability to perform the activities of daily living (ADL), the patients with right hemiplegia were significantly more successful. This suggests a relationship to involvement of the dominant (right) hand that favors this group of hemiplegics.

There was no significant difference between males and females regarding success or failure in ambulation and ADL.

Of the 119 hemiplegics, 35 were studied for visual perceptual disturbances. The incidence was high; only 3 of the 35 patients showed no defects in this respect.

The most striking findings in the 7 cases of severe visual perceptual disturbance were: 1) that these patients failed particularly in the activities of daily living, and 2) the hemiplegia was on the left side. Apparently, patients with right-sided hemiplegia have better prospects for rehabilitation in activities of daily living than do those with left-sided hemiplegia.

Since the sample of 35 patients was so small, no specific conclusions could be

drawn statistically as to the relationship between visual perceptual problems and the functional status of the patient in terms of ambulation and ADL. Moreover, the psychologic tests used in this study undoubtedly involve other intellectual factors besides visual perception. The more intellectually intact patients had fairly satisfactory language function and could cooperate in the examination procedure. Thus the data on these more testable cases lent additional bias to the results. A technique is needed for evaluating the degree of visual perceptual dysfunction in psychologically untestable cases.

REFERENCES

1. Peszczynski, M.: Ambulation of the severely handicapped hemiplegic adult, *Arch. Phys. Med.* **36:** 634 (Oct.) 1955.
2. Bruell, J. H.; Peszczynski, M., and Albee, G. W.: Disturbance of perception of verticality in patients with hemiplegia, *Arch. Phys. Med.* **37:** 677 (Nov.) 1956.
3. Bruell, J. H.; Peszczynski, M., and Volk, D.: Disturbance of perception of verticality in patients with hemiplegia: second report, *Arch. Phys. Med.* **38:** 776 (Dec.) 1957.
4. Lorenze, E. J.; DeRosa, A. J., and Keenan, E. L.: Ambulation problems in hemiplegia, *Arch. Phys. Med. & Rehab.* **39:** 366 (June) 1958.
5. Lorenze, E. J.; Simon, H. B., and Linden, J. L.: Urologic problems in rehabilitation of hemiplegic patients, *J. A. M. A.* **169:** 1042 (March) 1959.
6. Birch, H. G.; Proctor, F.; Bartner, J., and Lowenthal, M.: Perception in hemiplegia. 2. Judgment of the median plane, *Arch. Phys. Med. & Rehab.* **41:** 71 (Feb.) 1960.
7. Birch, H. G.; Proctor, F.; Bartner, M., and Lowenthal, M.: Perception in hemiplegia. 1. Judgment of vertical and horizontal by hemiplegic patients, *Arch. Phys. Med. & Rehab.* **41:** 19 (Jan.) 1960.
8. Eisenson, J.: Examining for Aphasia. New York, The Psychological Corporation, 1954, p. 23.
9. Cruickshank, W. M., and Rauss, G. M.: Cerebral Palsy: Its Individual and Community Problems. Syracuse, N. Y., Syracuse University Press, 1955.
10. Wechsler, D.: The Measurement of Adult Intelligence. Baltimore, Md., The Williams & Wilkins Co., 1944.
11. Wechsler, D.: Wechsler Adult Intelligence Scale. New York, The Psychological Corporation, 1955.
12. Bender, L.: The Visual Motor Gestalt Test and Its Clinical Use. New York, The American Orthopsychiatric Association, 1938.
13. Goldstein, K., and Scheerer, M.: Abstract and Concrete Behavior—An Experimental Study with Special Tests. Psychological Monographs, Vol. 53: No. 2. Evanston, Ill., American Psychological Association, 1941.
14. Knapp, M.: Problems in rehabilitation of the hemiplegic patient, *J. A. M. A.* **169:** 224 (Jan.) 1959.

CLINICAL MANAGEMENT OF HYPERTENSION IN THE OLDER PATIENT*

MORTON M. HALPERN, M.D.†

Miami, Florida

Because of our aging population more people are living longer; therefore it is reasonable to expect an increase in the incidence of multiple degenerative diseases in these older people, with the resultant creation of additional complicated therapeutic problems. During the last decade, progress in the management of hypertensive vascular disease has played a small, but definite, role in prolonging the life span of many patients with high blood pressure.

PRIMARY HYPERTENSION

Although primary hypertension seldom begins after the age of 48 (1), patients with this disease now are surviving longer due to improved care. Moreover, the malignant or accelerated form of hypertension is seen less frequently than formerly, as observed by Fishberg (2). He suggests that the decrease may be due to the prevalence of low-salt diets.

The net result is that elderly hypertensive patients require continued and strenuous therapy if death from stroke, cardiac decompensation, and renal failure is to be avoided or at least delayed. As evidence of the significant incidence of severe hypertension in the aged, an analysis of 170 consecutive patients in this category attending the hypertension clinic of the Jackson Memorial Hospital clearly showed that more than one-third were in the 51–60 age group (Fig. 1), and 75 per cent were over 50 years of age. More than one-third of them were 60 or older; a few were in their 80's. It should be emphasized that these patients had severe hypertension requiring specialized management. Milder cases easily controlled by simple regimens such as diet, sedatives and rauwolfia preparations, were not included in this group because they routinely are referred back to other appropriate clinics. Thus severe primary hypertension in the aged poses a therapeutic problem. Unfortunately, management is complex because of the complications common to the aging process.

SECONDARY HYPERTENSION

In any initial screening procedure, the cases of secondary hypertension must be weeded out. It is to be expected that they will represent a small minority, probably in the neighborhood of 5 per cent. Nevertheless, they remain a diagnostic challenge.

There are four major categories of secondary hypertension—neurologic, car-

* Presented at the 17th Annual Meeting, The American Geriatrics Society, Americana Hotel, Miami Beach, Florida, June 9 and 10, 1960.

† Clinical Assistant Professor of Medicine, University of Miami School of Medicine; Chief, Hypertension Clinic, Jackson Memorial Hospital, Miami.

Address: 1333 South Miami Ave., Miami, Florida.

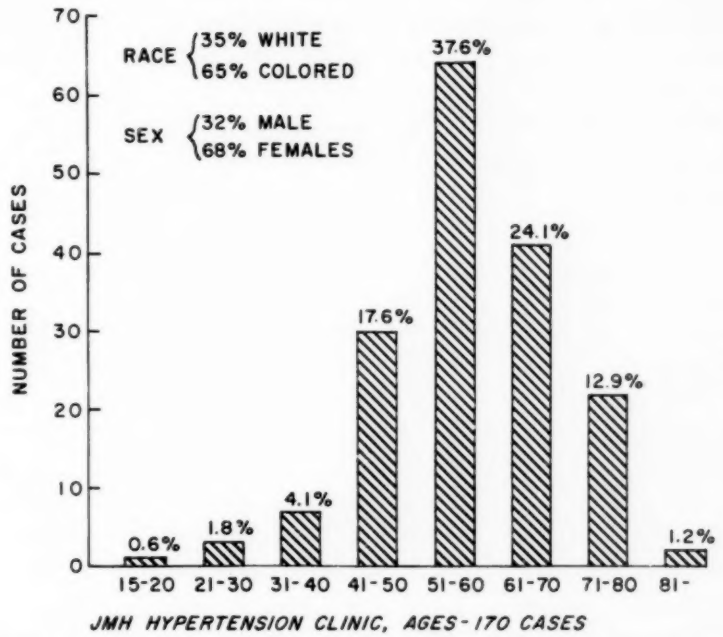


FIG. 1. Ages of 170 consecutive patients attending the Jackson Memorial Hospital Hypertension Clinic. All had severe complicated hypertension requiring specific therapy.

diovascular, endocrine and renal. The neurologic cases include those due to bulbar poliomyelitis, increased intracranial pressure, and acute porphyria. Fortunately, they are rarely encountered in the older age group.

The chief cardiovascular cause of diastolic hypertension is coarctation of the aorta—a condition which can be readily detected by examination of the femoral pulses and blood pressures. Its rarity is attested to by the fact that no cases were observed in our hypertensive clinic during the past five years.

Endocrine cases include pheochromocytoma, aldosteronism and Cushing's disease. Pheochromocytomas may be screened by taking an accurate history, performing the regitine or histamine test and checking the urinary catecholamines. These diagnostic procedures are not carried out routinely because of the infrequency of the disease despite the voluminous literature. Primary aldosteronism (3) should be suspected if bouts of weakness accompany the hypertension. A low concentration of serum potassium will help to confirm the diagnosis; however, additional diagnostic studies are then indicated. A case of Cushing's disease presents the typical moon facies, hirsutism, purple striae, and x-ray evidence of osteoporosis. Determination of the urinary 17-hydroxycorticoids is a diagnostic aid.

Chronic pyelonephritis is a more frequent cause of hypertension than formerly suspected, especially in the older patient with obstruction of the lower urinary tract (4). An intravenous pyelogram and quantitative urinary cultures might well be carried out in all hypertensive patients. Occasionally a unilateral contracted pyelonephritic kidney is found, and its removal may result in alleviation of the hypertension. Renal artery stenosis (5, 6) is proving to be a fertile field of

investigation. Since it is usually due to an atherosclerotic lesion, it probably will be diagnosed with increasing frequency in the aged. It should be suspected if, in a patient past the age of 50, hypertension is detected for the first time, or preexisting high blood pressure suddenly becomes worse or malignant. Surgical procedures offer great hopes in these patients. Diagnosis is aided by use of the intravenous pyelogram, the Howard test (7), the radiorenogram (8), and the aortogram (9).

DIAGNOSIS OF HYPERTENSIVE DISEASE IN THE ELDERLY

There is no indication at the present time that an elevated systolic blood pressure in the presence of a normal diastolic pressure has any influence on the patient's morbidity or longevity. Elevated systolic readings are commonplace in the aged because of the increased rigidity of an atherosclerotic aorta, but they also are found in the presence of complete heart block, aortic insufficiency or arteriovenous fistula. No specific therapy is required. On the other hand, the degenerative effects of hypertension appear to parallel the degree of diastolic elevation. The height of the diastolic pressure is a major criterion in determining the need for specific therapy.

Master and associates (10) came to the conclusion that a slight increase should be allowed in the accepted normal blood pressure level up to the age of 65. However, in all cases in which the diastolic level persists above 100 mm. Hg, it is to be assumed that the patient has hypertensive disease and should receive some form of medical guidance; above 110 mm., specific drug therapy is usually indicated.

No evaluation is complete without giving due consideration to the state of the cerebral circulation, the size of the left ventricle, the degree of hypertensive retinopathy, and the status of the kidneys. These end-organs are the major discernible areas afflicted by persistently elevated diastolic pressure. They offer objective measures of the deleterious effects, and these can be compared from time to time. At the Cleveland Clinic (11), an index for the severity of hypertension is based on the degree of involvement of these end-organs.

MANAGEMENT

Problems characteristic of older hypertensive patients

Deterioration of body tissues is common to the aging process. As the patient grows older, there is increasing probability that he will have more than one disease. This may modify the choice of therapy. More than ever, it becomes essential to treat the whole patient rather than the individual disease. Moreover, certain characteristics of one disease may have a therapeutic bearing on the other.

Although arteriosclerosis is not a process of aging, it is definitely more prevalent in the older age group. There is often significant compromise of the circulation to vital areas such as the brain, heart and kidneys. Thus there is an obligation to protect these fragile sclerotic vessels from an elevated blood pressure, especially in the brain where vascular hemorrhage is not uncommon. On the other hand, certain drugs may cause such a rapid drop in blood pressure that the circu-

lation through a sclerotic vessel to a vital area is decreased. It is essential that the therapeutic drop in pressure be gradual and not precipitous.

In the male, prostatic hypertrophy is common and often leads to urinary obstruction, especially if treated with drugs having parasympathetic blocking side-effects. Chronic pyelonephritis frequently results in renal impairment. Usually nephrosclerosis is present. The status of renal function should be evaluated early and periodically, before and during therapy. A too rapid drop in pressure could cause increasing azotemia or uremia if kidney function is impaired.

Many patients have diverticulosis and complain of constipation. Obstipation and even paralytic ileus can be precipitated by injudicious use of ganglionic blocking agents. A peptic ulcer may be aggravated by the stimulation of gastric acid induced by rauwolfia preparations.

Enforced idleness, geographic dislocation, widowhood, insecurity, and loneliness make older patients easy prey to the depressing side-effects of the rauwolfia drugs. They should be administered with great caution.

Diet

There is adequate evidence to warrant the institution of a few dietary principles for the treatment of these patients. Some relationship seems to exist between prolonged high-salt intake and elevation of blood pressure. Consequently, a low-sodium diet should be maintained, the extent depending upon the severity and resistance of the hypertension. The degree of success with diet therapy often parallels the energy and dedication displayed by the prescribing physician. Therefore, time must be taken to impress and instruct the patient.

Because of the increased incidence of arteriosclerosis in association with hypertension and obesity (12), it is of prime importance that all these patients receive a diet that is low in animal fat, and that those who are overweight have a low caloric intake. Obesity reduces the life span. Lowering the weight to normal often results in a gratifying decrease of the blood pressure level (13).

Specific drug therapy

The question of which elderly hypertensive patients require drug therapy has not been resolved to the satisfaction of all clinicians. In an analysis of only 58 patients, Perera (14) demonstrated to his satisfaction that prognosis is not improved by specific therapy, regardless of the degree of hypertension. However, Bechgaard and co-workers, as quoted by Master and associates (10), studied 1000 hypertensive patients. Their conclusion was that the mortality in patients past the age of 60 is definitely higher when the blood pressure stays in the range of 200/120 than when it is lower. Master and associates stated that, after the age of 65, females with levels of blood pressure above 212/112 and males with levels above 190/102 require drug therapy (10). The sex difference is related to the fact that the female tolerates long-term elevation of blood pressure better than does the male. Moyer (15) contended that there should be no distinction on the basis of age when considering specific therapy. At the Jackson Memorial Hospital Hypertension Clinic it is the policy to treat those elderly patients who show

progression of the disease as determined by assaying the degenerative effects on the "target areas" mentioned previously, namely, the brain, the eyegrounds, the heart and the kidneys.

Unquestionably, a hypertensive patient who has had a stroke or heart failure deserves to be protected if possible from a repetition of such episodes. Dustan (16) agrees unequivocally that all patients with signs of progressive vascular disease require therapy. It is generally believed that with the achievement of a normal or near-normal range of blood pressure, the incidence of these complications decreases.

In prescribing specific medication the clinician must keep in mind that lack of routine, forgetfulness, and bad habits are characteristic of these patients. Therefore, the mechanics of therapy should be as simple as possible.

Rauwolfia products have undergone extensive trial and are definitely, but mildly, hypotensive when administered orally in moderate dosage. Recent investigation (17) indicates that they act by releasing serotonin and catecholamines from binding sites in the brain and from the postganglionic sympathetic nerve fibers peripherally. Larger doses are required to obtain the central effect leading to sedation and depression. Since depression and suicidal tendencies may become a major problem in the aged, they should receive only the smaller dosages ranging between 0.1 mg. and 0.25 mg. of reserpine. The crude root or the alseroxylon fraction probably have less depressing side-effects (18). It is claimed that syringopine has primarily a peripheral action with little of the central sedative and depressing effect (19).

Thiazide derivatives—a new group of diuretics—have become a mainstay of modern hypotensive therapy. Chlorothiazide was the first one used clinically. As yet there is insufficient evidence that any of the newer preparations such as hydrochlorothiazide, flumethiazide, trichlormethiazide, hydroflumethiazide, or benzydroflumethiazide offer any advantages. All are less effective when administered alone than when other hypotensive agents such as rauwolfia, hydralazine, ganglioplegic drugs, or sympatholytic drugs are given simultaneously (Figs. 2–4).

The major complication of thiazide therapy is hypopotassemia. This is especially hazardous when the patient is being treated with digitalis, as occurs frequently. Digitalis toxicity with the resultant arrhythmias may be precipitated by the low level of serum potassium; it may even lead to sudden death. This cause-and-effect relationship was suggested first by Wilkins (20). As a precaution, these patients should be given supplemental potassium in the form of medication or of citrus fruits, with frequent checking of the serum levels. Intermittent administration of thiazide also has been recommended as a prophylactic measure. In some cases, it may be possible to discontinue digitalis therapy altogether, owing to the diuretic action of the thiazide. Occasionally this is found to be most gratifying in patients who previously had experienced alarming blackouts thought to be due to digitalis arrhythmias.

Hyperuricemia is another complication which occasionally produces symptoms of gout (21). Administration of probenecid, zoxazolamine, or acetylsalicylic acid

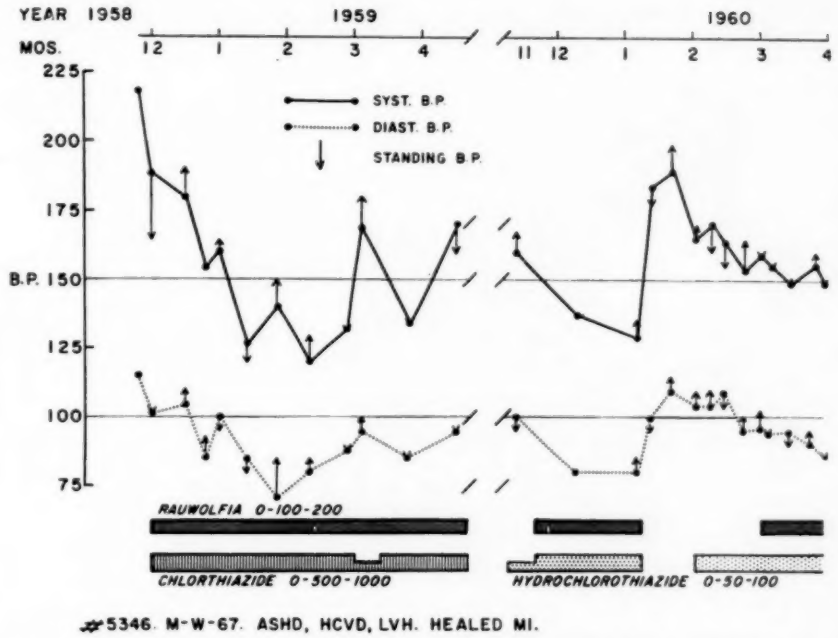


FIG. 2. This 67-year-old man had hypertension complicated by coronary disease, left ventricular hypertrophy and renal impairment. The blood pressure was controlled by rauwolfia and a thiazide derivative. This combination represented the most common form of treatment for hypertension in all age groups.

reverses this effect. The serum uric acid level should be checked in all patients before thiazide therapy.

Acute pancreatitis has been reported recently in 3 patients receiving thiazide medication (22), but the cause-and-effect relationship was not definitely established.

Figure 2 presents the data on a 67-year-old man with severe hypertension. There was no evidence of cerebrovascular disease, but he had grade II hypertensive retinopathy, left ventricular hypertrophy, a healed myocardial infarction, and albuminuria (1 plus) with slightly impaired renal function. His response to rauwolfia and chlorothiazide alone over a period of one and a half years was most satisfactory—a common result in both private and clinic elderly patients. Figures 3 and 4 also illustrate the treatment of elderly hypertensive patients with various combinations of thiazide and other drugs.

Veratrum derivatives are seldom of value when administered orally because the therapeutic doses almost invariably induce emesis.

Hydralazine is occasionally useful as a supplemental agent (Fig. 4). However, caution must be exercised in administering it to the aged because it increases the rate, work and output of the heart, and thus may lead to coronary insufficiency. It has even been stated that hydralazine is a more sensitive test for coronary disease than the Master "two-step" (23). Nevertheless, in patients who do not respond adequately to a combination of rauwolfia and a thiazide drug, it may be

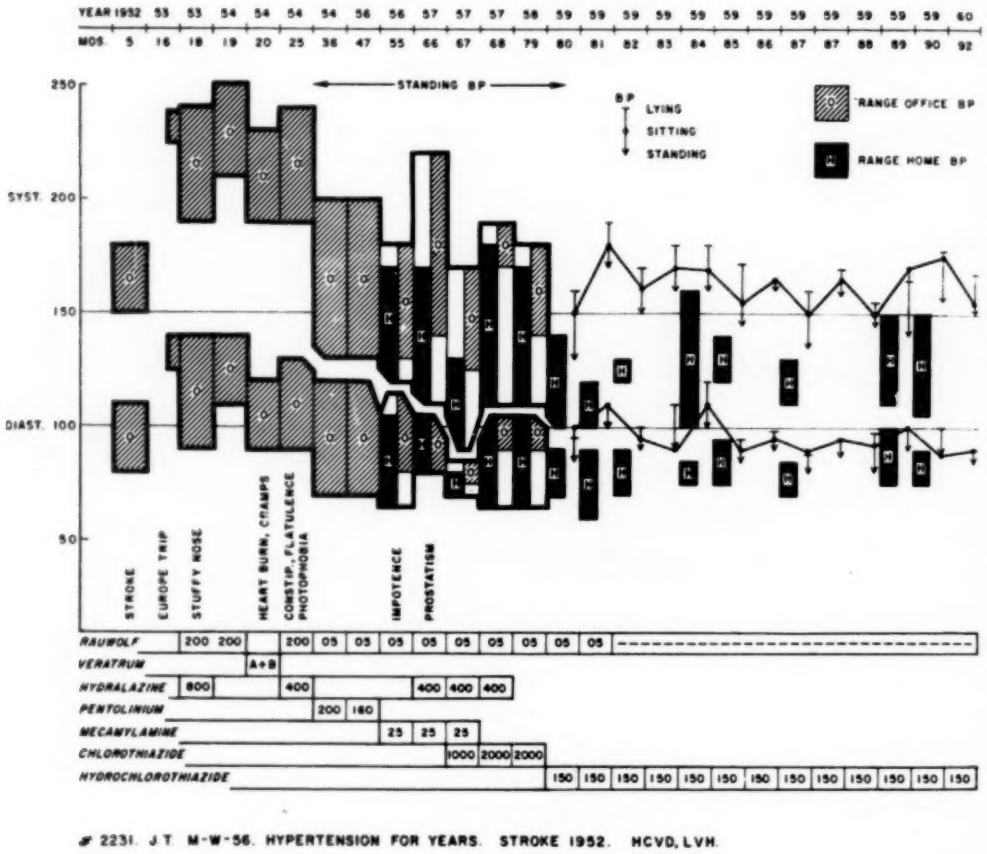
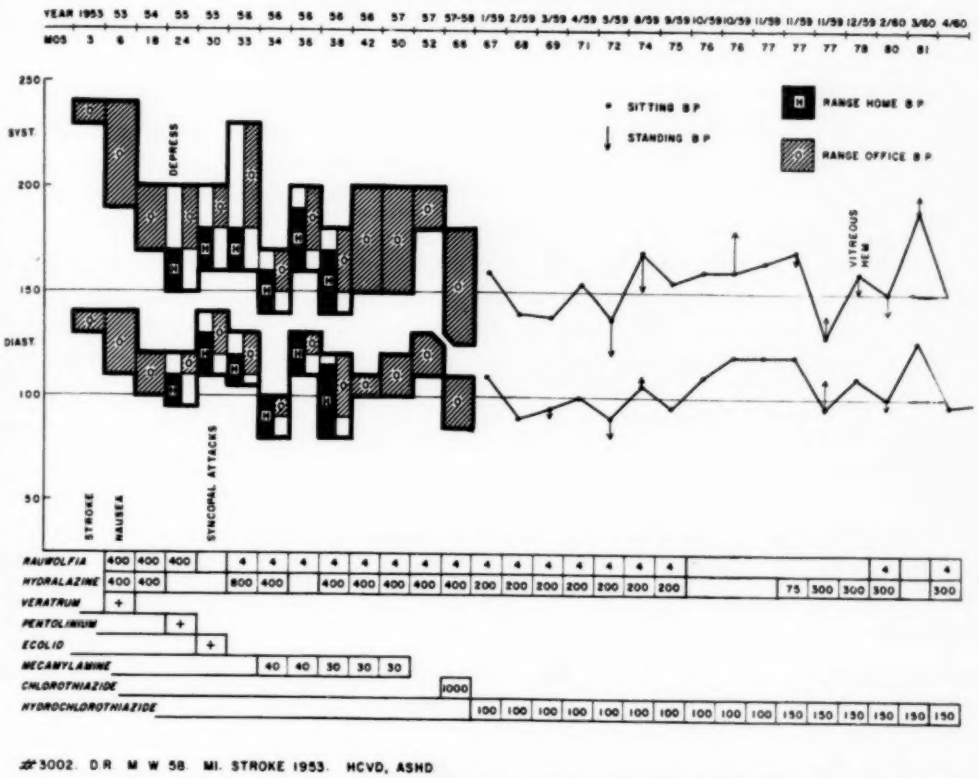

YEAR 1952 53 53 54 54 54 54 56 56 57 57 57 58 59 59 59 59 59 59 59 59 59 59 59 60
MOS. 5 16 18 19 20 25 36 47 55 66 67 68 79 80 81 82 83 84 85 86 87 87 88 89 90 92
STANDING BP
BP
LYING
SITTING
STANDING
RANGE OFFICE BP
RANGE HOME BP
SYST. 250
200
150
DIAST. 100
50
STROKE
EUROPE TRIP
STUFFY NOSE
HEART BURN, CRAMPS
CONSTIP., FLATULENCE PHOTOPHOBIA
IMPOTENCE
PROSTATISM
RAUWOLF 200 200 200 05 05 05 05 05 05 05 05 05
VERATRUM A+B
HYDRALAZINE 800 400 400 400 400
PENTOLINIUM 200 180
MECAMYLAMINE 25 25 25
CHLOROTHIAZIDE 1000 2000 2000
HYDROCHLOROTHIAZIDE 150 150 150 150 150 150 150 150 150 150 150 150
2231. J.T. M-W-56. HYPERTENSION FOR YEARS. STROKE 1952. HCVD, LVH.

FIG. 3. Eight-year follow-up of a patient with severe hypertension who had a cerebrovascular accident in 1952. The graph demonstrates the wide range of blood pressure determinations, the spectrum of drugs used over the years, the lower blood pressure readings recorded at home, and the final satisfactory control by reserpine and hydrochlorothiazide. During the 8-year period there was no repetition of the original episode, the left ventricle became smaller, and albuminuria decreased.

added to the regimen, if no severe coronary disease is present. The initial dosage should be small (10 mg. four times a day), gradually increasing to a maximum of 200–300 mg. per day. In this way the side-effects, especially annoying headaches, can be avoided. Furthermore, lupus-like complications have not been noted with this dosage schedule.

Ganglionic blocking agents such as chlorisondamine, pentolinium, mecamylamine and trimethidinium (24) serve their therapeutic purpose adequately, but should be used rarely, if at all, in the older patient. The side-effects occasioned by the coincidental but unwanted parasympathetic blockade can create serious problems which are better avoided. It is not surprising that patients receiving this type of medication rarely have a feeling of well being. To replace the ganglioplegic drugs, there is a new class of sympatholytic preparations which are proving to be quite potent, yet with few side-effects. One of them, bretylium tosylate



3002. D.R. M W 58. MI. STROKE 1953. HCVD, ASHD

FIG. 4. Data on a patient observed for more than 82 months. He had a cerebrovascular accident in 1953. Control of blood pressure was erratic until a combination of alseroxylon, hydralazine and hydrochlorothiazide was prescribed. Discontinuation of the hydralazine resulted in elevation of the blood pressure.

(25), is hypotensive initially, but the rapid development of tolerance and the production of facial pain nullifies its practical usefulness (26). On the other hand, guanethidine (27) is proving to be quite efficacious and has few side-effects; the main side-effect is diarrhea, which can be easily controlled by vagal blockers. With the advent of these, or similar preparations, the ganglionic blocking drugs may become obsolete except for parenteral use in acute hypertensive crises.

Enzyme inhibitors. Until we successfully prevent the development of hypertension or obtain the perfect antihypertensive agent, there will always be new therapeutic approaches to the problem. *Monamine oxidase inhibitors* have some hypotensive effect (28). It has been suggested that this is due to ganglionic blockade. The additional benefit achieved in cases of angina may be an indication for the use of this type of drug in some cases of hypertension.

SUMMARY

Increasing numbers of elderly hypertensive patients are the expected result of an aging population. In addition, salt restriction and specific hypotensive therapy are prolonging the lives of those afflicted with severe hypertensive disease.

Clinical management of the older hypertensive patient requires careful con-

sideration of problems inherent in the aging process. The ravages of progressive arteriosclerosis can modify therapy. With increasing longevity, the probability of multiple disease increases. In the older age group, due regard should be given to the patient's mental and emotional status. Loneliness, insecurity, idleness, anxiety, stress, depression, and even suicidal tendencies become major management problems. Furthermore, the lack of routine, the bad habits, and the forgetfulness of the older patient make therapy more difficult.

A minority of elderly hypertensive patients require specific therapy. Standards for elevated levels of blood pressure in the aged are similar to those for the average population; however, a slight progressive increase in the level is considered normal up to age 65. In planning therapy, it is important to determine the degenerative effect of the hypertension on target areas such as the brain, the eyegrounds, the left ventricle, and the kidneys. When they show signs of wear, vigorous hypotensive therapy is indicated.

Initially, treatment is oriented in the direction of salt restriction, elimination of obesity, decrease in the intake of saturated fat, and the administration of tranquilizers.

If the results are not satisfactory, more specific hypotensive therapy is indicated. First, a saluretic agent (chlorothiazide or similar preparation) is used; caution is necessary, if administered in association with digitalis medication. Rauwolfia preparations should be given only in small doses, because of the hazards of depression and even suicide. Occasionally it is necessary to add hydralazine to the regimen. Veratrum derivatives are rarely of value because therapeutic doses induce emesis.

Ganglionic blocking agents are extremely potent, but because of their distressing side-effects they should be avoided in the aged. Sympatholytic agents such as guanethidine may be expected to supplant ganglioplegics in the treatment of severe hypertension.

REFERENCES

1. Perera, G. A.: Hypertensive vascular disease (Transcription of a Panel Meeting on Therapeutics), *Bull. New York Acad. Med.* **30:** 390, 1954.
2. Fishberg, A. M.: *In* Panel Discussion on the Clinical Management of Hypertension, *J. Am. Geriatrics Soc.* **6:** 717, 1958.
3. Conn, J. W.: Primary aldosteronism; a new clinical syndrome, *J. Lab. & Clin. Med.* **45:** 6, 1955.
4. Keefer, C. S.: Pyelonephritis—Its natural history and course, *Bull. Johns Hopkins Hosp.* **100:** 107, 1957.
5. Poutasse, E. F., and Dustan, H.: Urologic causes of hypertension. I. Hypertension due to renal artery lesions, *Cleveland Clin. Quart.* **23:** 3, 1956.
6. DeCamp, P. T., and Birchall, R.: Recognition and treatment of renal arterial stenosis associated with hypertension, *Surgery* **43:** 134, 1958.
7. Conner, T. B.; Berthrong, M.; Thomas, W. C. Jr., and Howard, J. E.: Hypertension due to unilateral renal disease; with a report on a functional test, helpful in diagnosis, *Bull. Johns Hopkins Hosp.* **100:** 241, 1957.
8. Winter, C. C.: Unilateral renal disease and hypertension: use of the radioactive Diodrast renogram as a screening test, *J. Urol.* **78:** 107, 1957.
9. Poutasse, E. F., and Dustan, H. P.: Arteriosclerosis and renal hypertension—Indi-

cations for aortography in hypertensive patients and results of surgical treatment of obstructive lesions of renal artery, *J.A.M.A.* **165:** 1521, 1957.

10. Master, A. M.; Lasser, R. P., and Jaffe, H. L.: Blood pressure in white people over 65 years of age, *Ann. Int. Med.* **48:** 284, 1958.
11. Corcoran, A. C.; Dustan, H. P.; Taylor, R. D., and Page, I. H.: Management of hypertensive disease, *Am. J. Med.* **17:** 27, 1954.
12. Corcoran, A. C.; Page, I. H.; Dustan, H. P., and Lewis, L. A.: Atherosclerotic complications of hypertensive disease: relation to therapeutic response, to serum protein and to lipoprotein concentrations, *Cleveland Clin. Quart.* **23:** 115, 1956.
13. Master, A. M., and Lasser, R. P.: Relationship of the blood pressure to weight, height and body build in apparently healthy subjects, 65–106 years of age, *Am. J. M. Sc.* **235:** 278, 1958.
14. Perera, G. A.: Antihypertensive drug versus symptomatic treatment in primary hypertension. Effect on survival, *J. A. M. A.* **173:** 11, 1960.
15. Moyer, J. H.: Hypertension, *in* The First Hahnemann Symposium on Hypertensive Diseases, ed. by J. H. Moyer and others. Philadelphia, W. B. Saunders Co., 1959, p. 657.
16. Dustan, H. P.: Treatment of hypertension, *Modern Concepts Cardiovasc. Dis.* **29:** 585, 1960.
17. Brodie, B. B.: Effects of chlorpromazine, reserpine and monamine oxidase inhibitors on the cardiovascular system by interaction with central and peripheral neurohumoral agents, *in* Hypertension, Volume VII. Proceedings of the Council for High Blood Pressure Research, American Heart Association, November 1959, p. 82.
18. Ford, R. V.: Comparison of side effects of different rauwolfia compounds, *in* The First Hahnemann Symposium on Hypertensive Disease, ed. by J. H. Moyer and others. Philadelphia, W. B. Saunders Co., 1959, p. 39.
19. Plummer, A. J.: The pharmacology of rauwolfia compounds (including syringopine), *in* The First Hahnemann Symposium on Hypertensive Diseases, ed. by J. H. Moyer and others. Philadelphia, W. B. Saunders Co., 1959, p. 319.
20. Wilkins, R. W.: Precautions in use of antihypertensive drugs including chlorothiazide, *J. A. M. A.* **167:** 801, 1958.
21. Oren, B. G.; Rich, M., and Belle, M. S.: Chlorothiazide (Diuril) as a hyperuricacidemic agent, *J. A. M. A.* **168:** 2128, 1958.
22. Johnston, D. H., and Cornish, A. L.: Acute pancreatitis in patients receiving chlorothiazide, *J. A. M. A.* **170:** 100, 1959.
23. Hollander, W.: *In* Panel Discussion on Today's Recommendations for Drug Therapy in Hypertension. The First Hahnemann Symposium on Hypertensive Diseases, ed. by J. H. Moyer and others. Philadelphia, W. B. Saunders Co., 1959, p. 751.
24. Gifford, R. W.: Treatment of hypertension with trimethidinium methosulfate, a new ganglionic blocking agent, *Proc. Staff Meet., Mayo Clin.* **34:** 481, 1959.
25. Boura, A. L. A.; Green, A. F.; McCoubrey, A.; Laurence, D. R.; Moulton, R., and Rosenheim, M. L.: Darenthin, hypotensive agent of a new type, *Lancet* **2:** 17, 1959.
26. Hurley, R. E.; Page, I. H., and Dustan, H. P.: Bretylium tosylate as an antihypertensive drug, *J. A. M. A.* **172:** 2081, 1960.
27. Page, I. H., and Dustan, H. P.: A new potent antihypertensive drug. Preliminary study of [2-(octahydro-1-azocinyl)-ethyl]-guanethidine, *J. A. M. A.* **170:** 1265, 1959.
28. Hollander, W., and Wilkins, R. W.: Iproniazide and other amine oxidase inhibitors in arterial hypertension with or without complicating angina pectoris, and in hypertension, *in* The First Hahnemann Symposium or Hypertensive Disease, ed. by J. H. Moyer and others. Philadelphia, W. B. Saunders Co., 1959, p. 399.

HOST-TUMOR ANTAGONISM. XVII. TRAUMA AND CANCER*

LOUIS PELNER, M.D., F.A.C.A.†

Swedish Hospital, Brooklyn, New York

STATEMENT AND DEFINITION OF THE PROBLEM

The subject of post-traumatic cancer has incited impassioned discussion, rather than careful scientific thought. Unfortunately many cases have medico-legal overtones, which tend to becloud the issue. Stewart (1) calls post-traumatic cancer a problem in sociology propagated by a system of compensation medicine, by patients who have been conditioned to regard any lump as traumatic, and by physicians who will not receive a fee unless the condition is proved to be traumatic in origin. It must be granted that post-traumatic cancer is rare, but rarity must not be used as an argument for non-existence. There are many bona fide rare diseases that some practitioners may never see, but that nevertheless exist. Fat embolism is rare after major bone operations or severe fractures, but one does not deny its existence because of its rarity. There is a defect in simple logic in relegating something that is rare to non-existence.

As an example of the diversity of opinions on the subject, contrast the first quotation by Cowdry (2) and the second by Wainwright (3). Cowdry: "Some reported instances of single trauma cancers in man fulfill all of the necessary criteria for a positive diagnosis, but these are of rare occurrence." Wainwright: "If we admit that the relationship has been a true one, even in one case, we must consequently admit that it may likewise be a possibility in any other case in which this relationship comes up for serious consideration."

The battle lines are drawn exceedingly fine.

Moritz (4), an authority on the pathology of trauma, stated that it may be inferred from the results of animal experimentation that neither a mechanical injury, its complications, nor its sequelae are likely to cause tumor formation. He further stated that even though experimental results fail to provide positive evidence that a mechanical injury may cause a tumor, the possibility that tumors may be produced in this manner has not been disproved.

In Moritz' opinion, the case reports relating trauma to tumor formation do not substantiate the cause-and-effect relationship. He noted that there has often been no careful investigation of the authenticity of the injury, no bridging symptoms, and no evidence of tumor development at the site of injury. However, he stated that although many of the published reports are valueless, there are others in which the history of injury is authentic and in which a tumor developed subsequent to, and at the site of the injury. This form of ambivalence has been found

* Parts I–XVI of this study were published in the July, August, November (1956), April, May, June, August, October, November (1957), May, July (1958), May, September (1959), and May and July (1960) issues of the Journal.

† Attending Physician.

in the quotations of many authorities. Thus, by stressing appropriate quotations, statements can be used to prove or disprove either contention.

Ewing's (5) views relating to trauma and cancer were also ambivalent. He stated: "Present data (1935) confirm the view, long since adopted by pathologists that a single trauma of normal tissue is incapable of producing a malignant tumor." In the same article, however, he admitted the possibility that a mechanical injury, although incapable of producing tumor in normal tissue, may cause a tumor to form in a person who for other reasons is predisposed to neoplasm; also, if a mechanical injury has resulted in delayed healing due to infection, suppuration, or chronic irritation by foreign bodies, it may lead to tumor formation. He further stated that only a tumor with a structure representing an exaggeration or variation of the normal healing process and its sequelae, may safely be related to a single trauma. These modifying qualifications seem to dilute completely, if not controvert entirely, the first quoted statement of Ewing, and indicate that any primary tumor in a previously traumatized area may conceivably be caused by trauma.

Pack (6) believed in the principle of "traumatic determinism." A person with a silent or occult tumor is more liable to injury of that specific tumor site, because of the relative inflexibility of the area and the unrecognized, but slight disability of the part. A slight injury would not evoke pain in a normal area, but would do so when a pre-existing tumor was traumatized. In Pack's opinion, a single injury could aggravate the growth of a malignant tumor, by disrupting the tumor capsule, and causing hemorrhage and infection.

Much of the muddled thinking concerning the relationship between trauma and cancer revolves around the word "single." Millions of single traumas are experienced that do not result in cancer. On the other hand, we cannot ignore benign nevi as a source of malignant melanoma merely because it is only a rare one (perhaps 1 in a million) that becomes malignant. As Cowdry (2) stated, the adjective "single" is misleading, because a traumatic accident may be either instantaneous or prolonged (as in burns or frostbite). The insults to the cells do not cease immediately after the accident, but may be continuous or multiple. Moreover, all mechanical injuries probably also cause a local chemical injury.

Trauma is not to be considered as a sudden thing which precipitates tumor formation, but as a process which starts a chain reaction, at the end of which there may be tumor formation. Extensive destruction of tissue, continued fistula formation and suppuration, frequently disturbed processes of regeneration, foreign bodies (with noxious effects that can be considered both as mechanical and chemical trauma), long-continued mechanical irritations, and frequent exposure to roentgen-rays may be the individual links in the chain (7).

The question to be decided is, therefore, not whether a single trauma can be the cause of the tumor, but rather whether or not an acute trauma can set up a chronic tissue reaction which, in the presence of a suitable milieu, can cause the development of a malignant tumor.

Repeated stimuli are more apt to be carcinogenic than a single trauma, in that they repeatedly disturb the regenerative processes in the tissues. Repeated x-ray

examinations may act in this way, as may also inclusions of foreign bodies in a chronic wound.

Hueper (8), an expert on occupational cancer hazards, believed that cancer cannot be produced by nonspecific acute, single physical or chemical trauma to normal tissue, but that under special circumstances trauma may constitute a significant contributing or aggravating factor. He thought that, although trauma may not exert a direct carcinogenic effect, it may produce internal environmental, metabolic or hormonal disturbances that elicit or contribute to the appearance of specific cancers. He stated that a penetrating trauma may introduce specific exogenous carcinogens or generate such carcinogens from tissue elements by chemical action. It was his opinion that nonspecific physical or chemical trauma, such as severe contusions, burns, lacerations or inflammation, acting upon tissue previously exposed to such environmental carcinogenic agents as coal tar, petroleum oils, arsenicals or solar or ionizing radiations, may precipitate a sudden and rapid growth of cancer in the injured tissue. In other words, Hueper believed that in these instances the trauma acted as a co-carcinogen.

Hueper (8) also stated that under special conditions, traumatization of a cancer may accelerate local growth as well as metastatic spread. Injury to normal tissue remote from the site of cancer may, through arrest of tumor cells circulating in the blood within traumatically interrupted vessels, create a condition that is favorable to the localization of metastases.

NEOPLASTIC DISEASES OF OCCUPATIONAL ORIGIN OTHER THAN TRAUMATIC

Injuries may be of many types. They may include gunshot wounds, automobile accidents, lacerations and fractures, but also burns and the effects of atomic explosions. The dividing line between these physical injuries and injuries caused by noxious chemicals is not sharp, as a single trauma may last for a long time, *e.g.*, a burn or frostbite. The insults to the cells would be prolonged and continuous.

Occupational cancers may affect almost every part of the body, and vary widely in histologic structure (9). There are three major groups of these tumors: 1) direct contact, 2) excretory contact, and 3) depository contact. The direct contact group includes tumors of the skin caused by contact with carcinogenic agents, broncho-pulmonary tumors caused by inhaled substances, and deep-seated tumors caused by radiation. The excretory contact group consists of bladder tumors that are a result of working with aniline dyes. The depository contact group includes tumors due to the concentration of radioactive substances in bone, or to the deposition of ingested arsenic in the skin.

There appears to be no serious difference of opinion among authorities on neoplastic diseases of occupational origin (10). The following is a summary of their findings:

1. An unusually high incidence of lung cancer among miners of radioactive ore in Eastern Germany.
2. A high incidence of scrotal cancer in the almost extinct occupation of chimney sweeps in England.

3. A high incidence of bladder cancer among certain dye workers.
4. A significant increase in lung cancer among chromate and asbestos workers.
5. An increased incidence of skin cancer and leukemia from prolonged exposure to x-rays.
6. An increased incidence of skin and scrotal cancers among shale-oil workers.
7. An increased incidence of leukemia following atomic bombing.

There appears to be growing evidence also that bronchogenic cancer is encountered in greater than anticipated frequency among workers exposed to tar fumes, mineral-oil mists, chromium dusts, nickel-carbonyl vapors, arsenic dusts and fumes, asbestos dusts, isopropyl oil vapors and radioactive gases and dusts.

The 4 types of cancer most commonly observed after exposure to radiation are:

1. Cutaneous cancer due to the greater absorption of soft radiations by the skin.
2. Leukemia, because of the great sensitivity of the hematopoietic system.
3. Lung cancer due to inhalation of radioactive particles.
4. Sarcoma of bone due to ingestion of radioactive substances.

There are 3 distinct methods by which external radiation can induce tumor formation: 1) by a direct carcinogenic effect on a specific region; 2) by combining with other predisposing factors to exert the carcinogenic effect; (co-carcinogenesis); and 3) by remote action, in the same manner in which single or multiple whole-body exposures can induce leukemia. It is possible that the remote effect also shortens the latent period of spontaneously arising tumors.

THE POSTULATES LINKING TRAUMA WITH CANCER

The postulates are criteria that must be satisfied before a case of cancer can be attributed to a "single" trauma.

Segond's (11) postulates, which have been widely accepted by courts and oncologists as a valuable guide in assessing the status of post-traumatic cancer, are as follows:

1. The authenticity of the trauma to the part must be definitely established.
2. The trauma must be a significant one.
3. There must be reasonable evidence of the integrity of the part prior to injury.
4. The site of the tumor must correspond to the site of the injury.
5. The date of appearance of the tumor must not be so remote from the time of accident that the association would seem unreasonable.
6. The diagnosis of tumor must be established by clinical, roentgen and, if possible, by microscopic evidence.

Subsequently another limitation was added, namely, that the cellular character of the tumor should be relatively simple. This means that the tumor should consist of primitive-type cells, such as fibrous, synovial or fat cells which have probably reacted to injury, hemorrhage and loss of continuity of structure

by reparative hyperplasia—a condition which in rare circumstances may lead to neoplasia or even malignancy (12).

Courts subsequently added the requirement of "bridging symptoms," *i.e.*, symptoms that are continuous from the time of the trauma to the time of development of the tumor.

Ewing (13) believed that a reasonable lapse of time between an injury and the appearance of a tumor might range from three weeks to three years. He noted remarkable cases of acute sarcoma in which there was an unbroken continuity of symptoms from the time of injury to the time of appearance of the tumor. However this does not hold true in most cases. Usually there is an interval of days or weeks during which the symptoms of injury subside; this may be followed after a time by the appearance of a growing tumor. Such a time sequence has been observed in cases of bone sarcoma, in which the remarkable regenerative powers of the periosteum and blood vessels furnish a probable explanation for the neoplastic development. The stimulus to regeneration for some reason seems to cause an over-reactive response. In certain rare instances this may result in an unusually large population of young cells which, because of their number or specialized function, may be able to shift for themselves.

Segond (11), Ewing (13) and Warren (12) all emphasize "the integrity of the part prior to the injury" in determining the role of a traumatic event as the cause of a cancer. Obviously, macroscopic integrity is meant. One cannot guarantee the microscopic integrity of a part, which is really the important point.

Warren (12) restricted the meaning of "traumatic cancer" to cancer caused by a single injury. He listed 4 criteria that should be satisfied before a traumatic event could be considered as the cause of a cancer:

1. Integrity of the tumor site prior to the injury.
2. The injury must be severe enough to disrupt the continuity of tissue at the site and so initiate reparative proliferation of cells.
3. The tumor must follow the injury by a reasonable length of time.
4. The tumor must be of a type which might reasonably develop as a result of regeneration and repair in the specific tissues that received the injury.

When we say that a certain cancer was caused by a single trauma and that the criteria were fulfilled, it means that the single trauma probably initiated a series of alterations in the injured tissue that resulted in the development of cancer in that area.

SOME FUNDAMENTAL QUESTIONS

There are several fundamental questions to be asked in relation to the cancer cell. Unfortunately we do not know the answers in each instance, but we have to examine the questions nevertheless (14*a*).

1. When epithelial hyperplasia occurs from whatever cause, what determines whether the hyperplasia will be physiologic and regress after the stimulus is no longer active, or progress and develop into a neoplasm?
2. When a benign neoplasm has already formed, what determines its rate of growth? What situations will determine whether such a tumor (for example,

a polyp of the colon) will progress or retrogress, and even change into a malignant tumor?

3. When cancer has already become established, what situations determine whether it will grow swiftly or slowly, and whether it will or will not metastatize? What factors contribute to the "spontaneous" disappearance of a malignant tumor? Although the last-named phenomenon is rare, it is worthwhile to examine the circumstances under which it has occurred. Most cancers probably start as malignant conditions without going through the stage of benign neoplasm.

4. What factors determine the length of the latent period before a cancer develops? Long latent periods (twenty-five years or more) should be studied.

The "time factor" in the development of human and animal cancers is of tremendous importance. We do not know the etiology of most human cancers, and therefore usually cannot even roughly fix the length of time through which the stimulus may act, but this can be done with regard to certain industrial cancers. Industrial cancers have been well known since Percival Potts described the classic cancer of the scrotum in chimney sweeps. The aniline-dye tumor of the bladder is another example. The list of cancers that can be induced by industrial products is now very long. In most of the patients, these neoplasms developed after a long period of exposure to the carcinogen—as long as twenty-five years. However, many carcinogens exert their effects several years after exposure to them has ceased, and the carcinoma develops after a long or short latent period. In some instances the lengths of the exposure period and the latent period are the same, but they need not be; often the exposure period is much shorter. Thus an industrial cancer may become manifest many years after exposure to a specific agent has ceased. In the case of aniline-dye cancer of the bladder, the interval after exposure may be twenty to twenty-five years. In lung cancer due to asbestos inhalation, the interval may range from several months to twenty years. What has been occurring in the patient in the exposure-free interval? At present we cannot answer this question precisely.

The analysis of proved cases of industrial cancer is very important, because these are the only cancers in which the latent period or period of delay can be accurately determined. The time of injury can often be determined with great accuracy, a circumstance which is not possible in the ordinary run of neoplasms.

Stutz (14*b*) reported 4 cases of post-traumatic cancer that seem to fulfill the accepted criteria. In 1 case, seventeen months after an injury to the breast, a malignant tumor appeared; in 1 case, eight months after a fall and injury to the axilla, a giant-cell sarcoma developed that apparently originated from muscle fascia; in 1 case, six months after injury, a periosteal sarcoma of the tibia developed; and in 1 case a melanosarcoma of the retina appeared three years after injury. All of these patients had "bridging symptoms," but not necessarily up to the point of recognition of the tumor.

Stutz defined the term "latency" as the time interval during which an existing condition remains hidden or unrecognizable. He also divided the latent period into "latent period of carcinoma development" and "latent period of carcinoma

growth." The "latent period of carcinoma development" is the time necessary for the cancerogenic agent to get from the site of invasion of the body to the site of action; this applies specifically to chemical carcinogens. The designation also includes the time necessary for the individual physico-chemical cancerization of the cell to take place. Only when all these changes have occurred, can we say that cancer cells are present.

A single cancer cell or several cancer cells do not necessarily lead to a clinically manifest tumor. These cells go through either a short or long "latent period of carcinoma growth" which may last for months or for decades. If the period lasts until the death of the subject, then no clinically recognizable tumor ever develops. Stutz quotes Druckrey and Kupfmuller, who deduced theoretically that "latent" cancer cells may occur in the organism, *i.e.*, cells that have undergone the cancerization process but are not capable of growing into a morphologically recognizable tumor, or that may exist for a long period of time without developing into a tumor in the clinical sense. An example of the latter is the appearance of a chorio-epithelioma many years after the last pregnancy.

For the growth of cancer cells in the body, the following factors seem to be important.

1. The growth tendency and power of regeneration of the parent tissue, and the degree of de-differentiation of the cells. Thus tumors of bone marrow and of the lymphatic structures grow more rapidly than tumors of the nervous system. Histologically immature cells grow more rapidly than histologically mature cells.

2. The number of cancerized cells. Only when the necessary minimum number of cancer cells are present (varying from hundreds to thousands) does autonomous growth start.

3. Inhibitory factors in the cellular environment. Little is known of the nature of these factors, but they may account for the difference in behavior of cells of the tumor. The destruction of small colonies of cancer cells is a possibility in an unfavorable environment.

4. Stimulating factors in the cellular environment. These factors include the growth hormone of the pituitary, which influences the growth of both normal and cancer cells. As a result of destruction of tissue cells and leukocytes, growth substances are liberated which influence normal cell growth and probably cancer cell growth.

Stutz questioned whether a single trauma was capable of inducing cancerization in a previously healthy cell. He divided into two groups all his cases in which there was a possible connection between trauma and cancer. The first group included 3 patients in whom an injury had led to a chronic, inflammatory process, *e.g.*, chronic suppuration or a non-healing fistula. This fulfilled the present concept that a summation of traumatic occurrences is necessary for development of cancer. The second group did not have "bridging symptoms." The single insult apparently could not produce the summation of traumatic occurrences on a large number of cells. It is to be assumed, therefore, that "latent" cancer cells exist and that trauma represents a proliferation stimulus which results not only in

regeneration of destroyed normal cells but also in an increase of latent cancer cells. When these cancer cells reach the minimum number, they have the capacity for autonomous growth, which results in the development of a clinically recognizable cancer. The minimum number required is small when the cancer cells originate from a strongly proliferating parent tissue and show only a slight degree of histologic maturity, and when the inhibitory cellular factors of the environment are weak and the stimulating factors are strong. The period between the trauma and the clinical manifestation of tumor is the "latent period of cancer growth."

Thus the role of trauma in the causation of cancer is still causal, even if the trauma acts on cancer cells that are latent, stimulating them to growth with the formation of a recognizable tumor.

ANIMAL STUDIES

When a potent tar is applied two or three times a week to the skin of a mouse or a rabbit, papillomas may develop in from thirty to one hundred days, and carcinomas in from fifty to five hundred days. Carcinomas usually develop in tissue which is already papillomatous, and are of the ordinary cornifying epidermoid type (15).

Application of a carcinogenic hydrocarbon to a susceptible tissue leaves an indelible effect, so that subsequent stimuli, not of themselves carcinogenic, may result in the formation of tar cancer. Such stimuli may be called co-carcinogenic; trauma may be considered in this light (15). Berenblum (16) showed that croton oil, applied with or after benzpyrene, augmented the carcinogenic effect of the latter substance.

There are, however, several reports in the literature citing well controlled animal experiments in which cancer was produced by single exposures to chemical carcinogens (17). Different species reflect different susceptibilities. It is easiest to induce carcinogenesis in mice, and most difficult in monkeys.

Deelman (18) found that wounding of the tarred area localized and hastened tumor formation. The "Deelman phenomenon" has been confirmed using pure carcinogenic hydrocarbons. Cramer (19) found that injury to an already established benign tar papilloma is likely to precipitate malignant change. Orr (20) noted that wounding by means of subcutaneous linen sutures or adrenaline injections accelerated the development of tar tumors in the overlying skin. Rous and Kidd's (21) study of tar tumors in rabbits led them to conclude that trauma may precipitate the appearance of tumor.

Berenblum (22) produced skin carcinomas in mice by repeated freezing with carbon-dioxide snow. By previously sensitizing the skin with tar, a single freezing with carbon-dioxide snow produced the cutaneous carcinoma.

Trauma was considered by Rigdon (23) to act as a co-carcinogen in the production of tumors by methylcholanthrene in the white Pekin duck. Methylcholanthrene was applied locally to the skin beneath the wing. In 50 per cent of the ducks hemangiomas developed in the treated area of skin, whereas in 90 per cent of the ducks hemangiomas developed when the feathers were plucked both during

and after the time the carcinogen was applied. Rigdon believed that methylcholanthrene induced mutations in the cells of the skin that ultimately formed hemangiomas. The number of hemangiomas was markedly increased by the trauma that accompanied plucking of the feathers.

Virchow sponsored the hypothesis that tumors result from the persistent stimulation of tissues by irritants. If the hypothesis is to be modernized, these "irritants" should now be called "carcinogenic agents." However, nonspecific injuries or traumata may act as co-carcinogens in accelerating tumor formation in tissues previously treated with carcinogenic agents.

At present, one of the popular hypotheses concerning carcinogenesis is that of somatic mutation. Cell mutation may be brought about by a variety of physical and chemical agents. Strong (24) pointed out that all the physical and chemical agents that can induce mutation can also induce carcinoma. Boyland (25) believed that carcinogens cause the normal cell to mutate. Warren (26) also supported the concept of mutation with respect to cancers that may follow chronic injury in man. He believed that repeated repair following chronic injury ultimately leads to a mutation among the proliferating cells, or otherwise provides a stimulus for uncontrolled growth. Rigdon (27) concluded that if a mutation could occur following chronic irritation, it probably could also arise from the proliferating cells that accompany the repair following a single traumatic injury.

Saphir, Appel and Levinthal (28) studied the effects of a single mechanical trauma and of chronic irritation on the localization of metastases of the Brown-Pierce carcinoma in the long bones of rabbits. This is an highly malignant rabbit tumor which, when implanted into the testes, metastasizes early and produces generalized carcinomatosis. In the first set of experiments, the humerus was fractured and tumor cells were immediately injected into an ear vein. In the second series, the humerus was fractured, and two weeks later an intravenous injection of tumor cells was given. In a third series, the tumor was transplanted into the testis and two weeks later the humerus was fractured. In none of these animals was there evidence of tumor development at the site of fracture, although autopsy demonstrated metastatic tumors in many organs. The results of these experiments were purported to show that mechanical trauma or chronic irritation of bones played no part in the localization of metastases of the tumor in the rabbits.

These experiments are only valid for one type of cancer—the Brown-Pierce carcinoma in rabbits. The findings in some clinical cases noted in the next section seem to indicate that trauma does have some influence on the localization of metastases.

Black (29), a plant pathologist, made some interesting observations on a tumor of certain plants; the condition was called wound-tumor disease. This disease, which may affect many varieties of plants, is caused by the virus *Aureogenus magnivena*. Although the virus usually invades the whole plant, the tumors are local in character. Black's observations indicate that wounds play an important part in starting the development of the tumors in these plants. Tumors were observed on stems of sweet clover exactly at the point where the stems rested

on the rims of the pots in which the plants were growing. The observations on naturally occurring wounds were confirmed by experiment. Pins were used to make punctures in the internodes of healthy and diseased sweet clover stems. From 387 such punctures on virus-infected stems, 175 tumors developed, whereas from 505 corresponding wounds on virus-free plants, no tumors developed.

In the natural state, the virus is transmitted by specific insects of the family of agallian leafhoppers.

ILLUSTRATIVE CLINICAL FINDINGS

It was stated about 5000 years ago that a mammary tumor could be caused by trauma (30). Since then there has been heated controversy on the subject of injury in relation to cancer.

Pinheiro Guimaraes (31) believed that trauma does not play a significant role in the causation of cancer of the breast, but that various other factors play a more prominent part, such as humoral, functional, constitutional and hereditary factors. These latter influences cannot be closely defined, so they explain nothing. The author admits, however, that trauma produces solution of continuity, separation of cell groups and tissue masses, necrosis, hemorrhagic foci, accelerated regeneration, and cicatrization, and that some of these elements are of importance in oncogenesis.

Rixford (32) described the following case of cancer that he thought was probably due to trauma suffered three years previously:

> A male patient of 17 struck his right breast against a tree trunk in a fall. The breast became swollen. At the end of seven days, pain and soreness persisted, so the patient consulted a physician. After a few weeks of ultraviolet radiation and hot applications the swelling gradually subsided, except for a small mass the size of a chestnut.
>
> Eight weeks after the accident, the patient was ready to return to work. The following week he consulted his physician because the mass was growing. Several months later, it was as large as "half a lemon." He was sent to a surgeon. Six months after injury the mass was removed, but the surgeon stated that it did not resemble carcinoma and he did not send the tissue to the pathology laboratory. Two and a half years later, there were axillary nodes of large size in the opposite axilla; these proved to be metastatic carcinoma.
>
> About three years after the accident the patient had pleural effusion, pericardial effusion, and myriads of skin tumors. Autopsy showed hemopericardium secondary to a pericardial metastasis, fluid in both pleural cavities, metastases to the lymph nodes in each axilla, and widespread metastases in the lymphatic vessels of the skin.
>
> Histologically, the tumors all over the body were identical and consisted of large epithelial cells, sometimes arranged in gland-like order.

This case has been the subject of heated controversy. Stewart (1) wrote that Ewing was almost convinced that it was a genuine post-traumatic cancer, but that he (Stewart) had many serious reservations regarding it.

With reference to trauma and breast cancer, Handley (33) stated that a breast which receives a sudden blow may be 1) healthy, 2) in a precancerous condition, 3) the site of an unnoticed or of a known cancer, or 4) the site of a benign pathologic condition. He thought it extremely unlikely that a blow to a healthy breast can produce carcinoma. In his opinion, no mere traumatic alteration in

the relation of epithelium and connective tissue is in itself sufficient to account for carcinoma, provided the epithelium is healthy at the time of injury. The cells of a carcinoma are not normal cells, out of place. Before a cancer forms, there must be a deep-seated change in the epithelial cell. Moreover, according to Handley, it is probable that in many people with potentially carcinomatous epithelium, clinical cancer will never develop because the epithelium is held under some form of restraint. An injury may play a decisive part in the onset of a clinical carcinoma by freeing potentially carcinomatous epithelium.

Most cancers of the breast originate in the ducts, and they are preceded by a papillomatous overgrowth of the duct lining. At a certain stage in the history of the papilloma, its covering epithelium begins to invade the fibrous core; this stage is one of potential malignancy. If trauma now sets the cells free in the tissue spaces, clinical cancer will probably result.

There is another way in which injury can affect the breast, according to Handley. After operations for breast cancer, many islets of the cancer which have escaped removal may lie in connective tissue relatively dormant, or may smoulder along the lymphatic vessels. Mechanical injury can set free the quiescent and encysted groups of cancer cells from the sheath of connective tissue; if they gain access to the intercellular space, in which infiltration is easy, a large metastasis may result.

Handley believed that strenuous occupations and violent exercises should be forbidden for some years after a patient has undergone surgery for a breast cancer.

Gillis and Lee (34) described 24 cases of carcinoma arising in sinuses and scars of wounds incurred during the second world war. They pointed out that the dangerous scar was one in which cell division had been continuously stimulated for years under worsening conditions of deficient circulation and mechanical restriction, and that such factors might lead to an accumulation of metabolites or to local deficiencies which could eventually result in abnormal mitosis.

The development of carcinoma in scars has been observed chiefly following burns. The cause has been considered to lie in the poor blood supply of the scar tissue, the tendency to ulceration, the tendency to be easily injured because of decreased elasticity, the deeper penetration of the regenerating epithelium, the development of carcinogenic substances, the burning of organic tissues retained in the scar tissue, and the displacement of pieces of epithelium due to the burn (35).

The "time" factor—latent period or period of delay—can be accurately determined in cancer developing after burns. Treves and Pack (35) determined that the average period of delay in acute burns was four months, and the average period of delay in chronic burn scars was thirty-two and a half years.

Frost-bites, like burns, can be accurately dated and some of these are also followed by cancer. The period of delay in some of Hueper's (36) cases ranged from ten months to fifteen years.

It is known that periods of delay in the development of cancer are less in younger than in older patients, and are less in cases of sarcoma than in cases of carcinoma.

Pack (37) reported three patients as presumably demonstrating the development of traumatic cancer. One was a 55-year-old woman who was operated on for carcinoma of the transverse colon, and in whom a malignant spindle-cell and giant-cell sarcoma developed two years later in the operative scar. Another was a 55-year-old baker in whom a malignant synovioma and later a benign osteoma developed at the exact site of a previous painful injury. The third was a 34-year-old girl who was thrown by a mule, and who also sustained an injury to her thigh from the mule's hoof. About six months later a tumor appeared at the precise location of the injury; it proved to be a myxoliposarcoma.

There are good grounds for believing that injury plays a definite etiologic role in melanoma. For example, in melanoma developing from a benign pigmented mole, there is often a history of injury or of incomplete surgical removal. Also, in a large proportion of patients with melanoma of the foot or leg, there may be no history of a benign mole, but rather a history of injury.

Pack, Lenson and Gerber (38) formerly held the opinion that repeated injury to pigmented mole is an important contributing factor in the change to malignant melanoma. Their strongest argument in favor of this theory was the finding of large numbers of melanomas on the soles of the feet where pre-existing pigmented moles would be exposed to great pressure. Pack *et al.* now believe that the histologic character of the mole (for example, a junctional nevus) is more important in the etiology than is accidental injury.

Hewer (39) noted that although malignant melanoma is rare in colored races as a group, it is nevertheless common in natives of the Anglo-Egyptian Sudan. Among the patients with tumor at the Johns Hopkins Hospital, the ratio of white to colored patients with malignant melanoma was 3 to 1. In specimens examined in Khartoum from Sudanese natives, the condition was quite common. There was a high incidence of malignant melanoma on the lower extremity and especially on the sole of the foot. In Hewer's opinion, this distribution in people who walk barefoot in a country abounding with thorns and sharp stones, was strong evidence for the significance of trauma in the etiology. He believes that trauma is a more important predisposing factor than skin color in the etiology of malignant melanoma.

Pack and Ariel (40) stated that fibrosarcomas usually develop spontaneously with no apparent relationship to any etiologic agent. In no patient in their series could trauma be considered as the sole etiologic factor in the formation of fibrosarcoma, but some patients did relate injury to the discovery of the tumor.

Although there were cases in which sarcoma developed after injury in the first world war, the incidence was low. Fibrosarcomas have been recorded as developing in war wounds (41), operative scars (42) and at the site of a kick by a calf (43). They may occur in scar or in granulation tissue.

Stout (44) noted that fibrosarcoma developed in scar tissue or at the site of a previous injury in a fair number of his cases. This lesion has also been noted at the site of a burn (45), in the area of a chronic varicose ulcer (46), and in an area where an injection of Salvarsan was given (47). Pack and Ariel (40) also reported a case of fibrosarcoma originating in a burn scar.

Pack and Eberhart (48) stated that malignant tumors of striated muscle, the

rhabdomyosarcomas, are considered to be congenital. The striated muscle cell is a completely differentiated end-product. According to embryologists it is capable of enlargement, but not of cell division, in post-natal life. Pack and Eberhart believed that trauma plays no role in the causation of these tumors, but that the limb or part containing the tumor is predisposed to injury. Although some of their patients definitely recalled trauma to the area that subsequently bore the tumor, trauma was not considered to be an etiologic factor in their series.

Seelig (49) cited a typical history of post-traumatic cancer. A man struck his shin violently against a steam pipe, and a hematoma developed. Roentgenograms taken at that time showed nothing abnormal. The post-traumatic swelling and pain persisted, however, and within several months an osteosarcoma developed at the site of injury, resulting in death.

A fairly typical case (50) was reported in the medico-legal columns of the *British Medical Journal*. A 49-year-old man was kicked by a cow above his right knee in October 1954. At first he could not walk. Several days later, he showed his superior that he had a large bruise over this area. Later, he complained of pain in the knee after heavy work. A biopsy was performed and revealed fibrosarcoma. The leg was amputated in January 1957. In February 1958, metastatic deposits were found in his chest and an enlarged gland was found in his groin. He died on July 4, 1958. The tumor had occurred at the exact site of his injury. Compensation was allowed by the courts.

Willis (15) thought that the evidence is inconclusive for invoking injury as a cause of bone sarcoma, and that exceptional cases in which sarcoma appears a few months or years after injury of the bone at a particular site, are really chance occurrences.

Although in most cases of bone sarcoma, trauma does not appear to play a significant role, there are on record a substantial number of attested cases in which the traumatic origin must be accepted (13).

There appears to be a significant relationship between trauma and the subsequent tumor in Ewing's sarcoma (51). Of 167 cases studied, 40 had a history of trauma that seemed definitely related to the subsequent onset of symptoms. The average lapse of time between trauma and symptoms of sarcoma was five and a half months (ranging from a few days to more than one year). In cases of fibrosarcoma, 10 of 30 patients gave a history of antecedent trauma. Of particular importance is the fact that 2 of these patients had fractures at the identical site where sarcoma subsequently developed.

The experience with benign giant-cell tumor is similar, in that a substantial number of patients give a history of antecedent trauma (51). In some cases in which roentgenograms were taken immediately after injury and at intervals thereafter, the gradual development of areas of bone destruction could be traced.

It is now generally accepted that desmoid tumors arise from fibroblastic proliferation in the deep fascia between muscles, or in aponeuroses. Pack and Ehrlich (52) stated that a desmoid tumor may have a microscopic structure varying from an acellular fibroma to low-grade cellular fibrosarcoma. Trauma is an etiologic factor, and a history of trauma is usually obtained. Occasionally, the tumor

may occur in an old operative scar. Trauma to the muscles of the abdomen during pregnancy and parturition has been implicated, and a hormonal element may also be involved.

Gatchell, Clagett and McDonald (53) of the Mayo Clinic reported the following case of desmoid tumor of the intercostal muscles and thoracic wall:

> The patient, a 27-year-old pregnant woman, had injured her right chest fifteen months before in an auto accident. The pain was not disabling at first, but about six months later it had increased in intensity. She consulted a physician one year after the accident. She was pregnant and had lost weight during the preceding months. A roentgenogram revealed an abnormality in the right upper part of the thorax. About twenty-six months after the accident, a thoracotomy was performed and a biopsy specimen was obtained of a tumor involving the right upper thoracic wall. The diagnosis was low-grade fibrosarcoma, but the diagnosis was changed to nonspecific fibrous proliferation after review of the section.
>
> Re-exploration was carried out, and a large tumor was removed that had arisen from tissue in the third intercostal space. The histologic picture was that of actively proliferating fibrous tissue, invading and replacing muscle, but lacking cytologic evidence of malignancy.

Tanz (54) reported the following case of fibrosarcoma resulting from a single injury:

> A white man, aged 24, struck his left hand on a guard rail while loosening a nut wrench. The accident caused soreness on the dorsum of the hand, followed in ten days by numbness and a tight feeling over the palmar aspect of the third metacarpal. Hot soaks were advised. Four months later he had little disability, although tingling could be produced by percussion over the median nerve. The patient failed to keep subsequent appointments. Fourteen months after the accident the patient complained of a pinching, burning sensation where the middle and index fingers join the palm, and there was hyperesthesia over this area. A pea-sized, painless nodule was felt in the palm, but this could not be detected later. He was operated on for a carpal tunnel syndrome, but no abnormalities were found and he returned to work one week after operation. He felt improved.
>
> Four months after this operation a small nodule was noted over the operative scar, and a month later the nodule had increased in size. About eighteen months after the accident, exploration of the scar revealed a brownish mass deep in the palmar fascia. Pathologic examination revealed fibrosarcoma arising in the soft tissue of the hand. Two days later the arm was amputated at mid-level.

Clarke, Walsh and Schreck (55), in an article on the management of soft-tissue sarcomas, stated that an injury is often mentioned by the patient in giving the history of the illness. These authors were emphatically of the opinion that a synovioma may be the result of a single injury. They further stated that accidental injury and incisional biopsy frequently initiate a phase of intensive growth in previously dormant tumors.

Carson (56) had 2 cases that satisfied, in his view, the postulates demanded for a diagnosis of post-traumatic cancer:

> A woman of 64 severely traumatized her right hand and forearm in a washing-machine wringer. The wound did not heal in eight weeks and a skin graft was applied. Three months after injury she noticed a tumor on the back of her right wrist, which grew rapidly. The next month, the tumor was excised; it proved to be a fibrosarcoma. Following x-ray treatment, there was a recurrence, which required amputation of the forearm about one year after injury. The patient died about two years after the injury. The anatomic diagnosis

was fibrosarcoma of the right forearm with metastases to the right axilla, pleura and hilar lymph nodes.

A man aged 60 was getting off a street car in the rain, and struck his right femur against a fire hydrant. This injury was followed by pain for three weeks. Ten weeks later pain recurred in the right knee, and a radiographic diagnosis of a primary bone tumor was made. Biopsy of the tumor showed that it was a fibrosarcoma, so hip-joint disarticulation was performed.

In the section on Diagnostic Problems, *Journal of the American Medical Association*, Kushner and Szanto (57) described a case of synovial sarcoma in a 39-year-old woman who had severely injured her left knee twenty-four years before. At times of minor trauma, the swelling would recur throughout the years. Sixteen months before her final admission, foot drop was first observed. Two weeks before her final admission cough developed, with hemoptysis and signs of pleural effusion. Szanto, in commenting on this patient, stated that a history of injury is common in patients with synovial sarcoma; moreover, the frequency of synovial sarcoma in a typical site of traumatic bursitis like the popliteal space supports the hypothesis of an etiologic relationship between injury and synovial sarcoma in some cases.

Levinson and Furst (58) described a patient with a fairly typical history. The patient was struck on the inner part of the left thigh with an 100-pound can, and hematoma developed at the site of injury. Seven months later a cystic mass was removed from this precise location and was found to contain old and fresh blood. Microscopic examination of the tissue disclosed a synovial sarcoma.

La Rocca (59) reported the case of a 57-year-old man who, while directing a tow-boat under a bridge, suffered a severe blow on his right chest. Pain developed in this area and the patient lost 20 Kg. over a period of ten months. On the basis of clinical and roentgenologic findings, a diagnosis of cancer of the lung was made. Autopsy revealed a cavitary cancer with invasion of the pleural dome, corrosion of the upper dorsal vertebrae and the heads of the first three ribs, and widespread metastases. The patient had been seemingly healthy before the blow on his chest, and there were witnesses to the injury.

A case that does not satisfy all the postulates was reported by Pfeffer (60):

A truck driver suffered a crushing injury of the chest when he was accidentally thrown into a ditch while loading machines. Examination of the chest by a physician seven days after the injury showed no external changes, but there was pain on pressure over the entire *left* side of the thorax. The next month, diagnosis of left-sided pleurisy was made.

Two months after injury, the patient was hospitalized because of fatigue, cough, night sweats, pains in the chest and poor appetite. On roentgenography, an area of infiltration in the *right* middle and lower lung was found.

Nine months after the injury, the patient was again hospitalized, and was found to have gangrene of the right lower lobe of the lung. The abscess cavity was opened. At that time the pulmonary gangrene was considered to be a result of the injury.

The patient was examined one year later, and at that time he stated that he had expectorated blood for several days after the accident. He began to fail rapidly. About six months later another operation was performed. On the basis of biopsy findings, a diagnosis of carcinoma of the *right* lung was made.

In a final evaluation of the case, made after death, it was decided that the pulmonary carcinoma had been present at the time of the injury.

Chauvin (61) of Marseille reported a case of severe trauma of the testis, which necessitated surgical intervention. Blood clots were evacuated, and epididymectomy was performed for infarction of the caput epididymis, along with debridement of a hematoma at the upper pole of the testis. There was a rapid postoperative increase in the size of the testis, and gradual induration followed. Ten weeks later, orchiectomy was performed. Histologic study revealed a teratoma.

Kotin and Kahler (62) described a patient in whom trauma acted as a co-carcinogen. This patient, a 60-year-old man, was for thirty years constantly exposed to heavy refined oil used in transformers and electric motors. During his work, he cut the dorsum of his hand. After the injury, the would healed slowly. In the course of his work the lesion was scraped. Then a severe blow was sustained on this site, resulting in the first appearance of a squamous-cell carcinoma, which began to grow rapidly. The authors believed that trauma acted as a co-carcinogen, with the occupational exposure to petroleum products serving as the initiating mechanism and the slow wound healing acting as the promoting agent.

Schreck (63), in a statistical study of skin carcinomas, observed that in 13 (2.8 per cent) of 457 cases the tumor developed in a pre-existing scar. Eleven of the 13 tumors were located in the scalp, trunk, arms and legs. Schreck concluded that if scarred skin is more susceptible to the development of cancer than is normal skin, then a single traumatic injury may ultimately result in cancer.

Moritz (4) took issue with this statement. He noted that 6 of these scars were from severe burns, 1 represented an x-ray burn, and 3 were chronically inflamed lesions of which one was an old surgical wound, one a varicose ulcer and one an ulcer complicating milk leg; therefore the trauma was definitely more than a single mechanical injury. This is specious reasoning. The single trauma that causes a scar can be considered the cause of the cancer, because it initiates a series of alterations that eventuate in the cancer. If the single trauma had not occurred, it is extremely doubtful that a cancer would have developed at the precise location.

Pack (64) questioned whether trauma could cause localization of metastases in injured tissues. Although the injured tissues could act as a "locus minoris resistenciae," there must of necessity have been malignant cells in the circulation at that precise time. He reported the case of a young male patient who was treated previously for reticulum-cell sarcoma of the nasopharynx. The patient injured his penis in sexual play, and a hematoma developed at this site. The hematoma did not disappear. When the clot was evacuated, it was found to consist in part of tumor tissue, which proved to be reticulum-cell sarcoma.

From the nature of the problem, there is also a fairly large legal literature on the subject. This is for the most part unsuitable for analysis from a medical point of view. The article by Russell and Clark (65) is an exception, in that it clearly states the postulates that should be satisfied before a cancer can be labeled as traumatic, and presents a hypothetical case which is tested against the postulates.

It is almost universally agreed that tumors of the internal organs, *e.g.*, gastric, rectal, pancreatic, hepatic and uterine tumors, are not caused by single traumatic

injuries. This list should also include tumors of the lung, esophagus, and gall bladder (66).

SUMMARY AND CONCLUSIONS

From the data in discussions, case reports and pertinent experimental evidence, it appears that cancer in man can result from a single trauma (as defined in this essay), although this must be considered a rare occurrence. Trauma is therefore neither the most important nor the most frequent cause of cancer. The type of cancer most often associated with trauma is sarcoma.

According to various authorities, there are three possible mechanisms relating cancer to trauma: 1) a cell mutation may occur as a result of the local environmental change accompanying the process of repair after injury; 2) trauma may act as a co-carcinogen; and 3) a carcinogenic agent may accompany the agent inflicting the injury.

The concept that a single trauma may activate a "latent" cancer cell is a useful one in explaining some of the recorded cases. The effect of a single trauma on the stimulatory and inhibitory factors in the cellular environment is also important, and may determine whether the "latent" cancer cell multiplies sufficiently or has the vitality necessary for autonomous growth.

Single trauma is not a significant factor in the etiology of tumors of the internal organs.

In some of the recorded cases, trauma only called attention to pre-existent unrecognized cancer.

REFERENCES

1. Stewart, F. W.: Occupational and post-traumatic cancer, *Bull. New York Acad. Med.* **23:** 145, 1947.
2. Cowdry, E. V.: Cancer Cells. Philadelphia, W. B. Saunders Co., 1955.
3. Wainwright, J. M.: Single trauma, carcinoma and workmen's compensation, *Ann. J. Surg.* **5:** 433, 1928.
4. Moritz, A. R.: The Pathology of Trauma. Philadelphia, Lea and Febiger, 1942.
5. Ewing, J.: The modern attitude toward traumatic cancer, *Bull. New York Acad. Med.* **11:** 281, 1935.
6. Pack, G. T.: Relation of cancer to trauma, *Compens. Med.* **3:** 5, 1950.
7. Ebert, G.: Trauma and development of tumor and its evaluation, *Med. Klinik* **19:** 1601, 1954.
8. Hueper, W. C.: Medicolegal aspects of cancer, *Am. J. Clin. Path.* **25:** 116, 1955.
9. Anonymous: Trauma and cancer, *Cancer Bull.* **8:** 55, 1956.
10. Pedden, J. R.: The lawyer and the physician examine the question of traumatic carcinogenesis, *J. Michigan State M. Soc.* **52:** 414, 1953.
11. Segond, M. P.: Cancer and occupational accidents, *Proc.-verb. A. franç. de chir.* (Paris) **20:** 745, 1907. Quoted by Rigdon, R. H. (ref. 27).
12. Warren, S.: Minimal criteria to prove causation of traumatic or occupational neoplasms, *Ann. Surg.* **117:** 585, 1943.
13. Ewing, J.: Neoplastic Diseases. Philadelphia, W. B. Saunders Co., 1942.
    Ewing, J.: Bulkley Lecture—Modern attitude toward traumatic cancer, *Arch. Path.* **19:** 690, 1935.
14. *a*) Cutler, M.: Observations upon the nature of the cancer process, *Chinese M. J.* **51:** 627, 1937.

b) STUTZ, E.: Contribution to the problem of "carcinoma and trauma," *Strahlentherapie* **95:** 416, 1954.
15. WILLIS, R. A.: Pathology of Tumours. London, Butterworth and Co., 1948.
16. BERENBLUM, I.: The cocarcinogenic action of croton resin, *Cancer Res.* **1:** 44, 1941.
17. *a*) MIDER, G. B., AND MORTON, J. J.: Skin tumors following a single application of 20-methylcholanthrene in C57 brown mice, *Am. J. Path.* **15:** 299, 1939.
b) LAW, L. W.: Multiple skin tumors in mice following a single painting with 9, 10-dimethyl-1, 2-benzanthracine, *Am. J. Path.* **17:** 827, 1941.
c) CRAMER, W., AND STOWELL, R. E.: Skin carcinogenesis by a single application of 20-methylcholanthrene, *Cancer Res.* **3:** 36, 1943.
18. DEELMAN, H. T.: Tar cancer and regeneration of cells, *Ztschr. Krebsforsch.* **21:** 220, 1924. Quoted by Willis (ref. 15).
19. CRAMER, W.: Quoted by Willis (ref. 15).
20. ORR, J. W.: Effect of interference with the vascular supply on the induction of dibenzanthracene tumours, *Brit. J. Exper. Path.* **16:** 121, 1935.
21. ROUS, P., AND KIDD, J. A.: Comparison of virus-induced rabbit tumors and the tumors of unknown cause elicited by tarring, *J. Exper. Med.* **69:** 399, 1939.
22. BERENBLUM, I.: Tumor-formation following freezing with carbon dioxide snow, *Brit. J. Exper. Path.* **10:** 179, 1929.
23. RIGDON, R. H.: Trauma and cancer. An experimental study in the white Pekin duck, *A. M. A. Arch. Path.* **61:** 443, 1956.
24. STRONG, L. C.: The induction of germinal mutations by chemical means. Fourth Internat. Cancer Congress, St. Louis, 1947, quoted by Rigdon, R. H. (ref. 27).
25. BOYLAND, E.: Different types of carcinogens and their possible mode of action, *Cancer Res.* **12:** 77, 1952.
26. WARREN, S.: Neoplasms, *in* Anderson's Pathology. St. Louis, C. V. Mosby Co., 1953.
27. RIGDON, R. H.: Trauma and cancer; a review of the problem, *South. M. J.* **51:** 1105, 1958.
28. SAPHIR, O.; APPEL, M., AND LEVINTHAL, D. H.: Attempt to localize tumor metastasis in long bones by mechanical trauma, *Cancer Res.* **5:** 722, 1945.
29. BLACK, L. M.: Virus tumors in plants. Sixth Growth Symposium, 1947, p. 79.
30. IMHOTEP: The Edwin Smith Surgical Papyrus. Chicago, University of Chicago Press, 1930. Quoted by Tanz, S. S. (ref. 54).
31. PINHEIRO GUIMARAES, U.: Trauma and mammary cancer, *An. brasil. ginec.* **14:** 185, 1942.
32. RIXFORD, E.: Traumatic carcinoma of the breast, *Tr. Am. Surg. A.* **55:** 325, 1935.
33. HANDLEY, W. S.: Trauma and breast cancer, *Med. Press* **204:** 436, 1940.
34. GILLIS, L., AND LEE, S.: Cancer as sequel to war wounds, *J. Bone & Joint Surg.* **33B:** 167, 1951.
35. SCHMID, M. A.: On the connection between tumor formation and accident, *Münch. med. Wchnschr.* **95:** 1063, 1953.
35. TREVES, N., AND PACK, G. T.: The development of cancer in burn scars, *Surg., Gynec. & Obst.* **51:** 749, 1930.
36. HUEPER, W. C.: Occupational Tumors and Allied Diseases. Springfield, Ill., Charles C Thomas, Publisher, 1942.
37. PACK, G. T.: The relation of cancer to trauma, *Compens. Med.* **3:** 5, 1950.
38. PACK, G. T.; LENSON, N., AND GERBER, D. M.: Regional distribution of moles and melanomas, *A.M.A. Arch. Surg.* **65:** 862, 1952.
39. HEWER, T. F.: Malignant melanoma in coloured races: the role of trauma in its causation, *J. Path. & Bact.* **41:** 473, 1935.
40. PACK, G. T., AND ARIEL, I. M.: Fibrosarcoma of the soft somatic tissues, *Surgery* **31:** 443, 1952.
41. THIES, O.: Sarcoma after war wounds, *Zentralbl. f. Chir.* **63:** 822, 1930.

42. Hamant, A.; Cornil, L., and Mosinger, A.: Fibroblastic sarcoma of the thigh developing in an operational scar, *Ann. d'anat. path.* **7:** 373, 1930.
43. Ivins, J. C.; Dockerty, M. B., and Ghormley, R. K.: Fibrosarcoma of the soft tissues of the extremities, *Surgery* **28:** 495, 1950.
44. Stout, A. P.: Fibrosarcoma; the malignant tumor of fibroblasts, *Cancer* **1:** 30, 1948.
45. Fleming, R. M., and Rezek, P.: Sarcoma developing in an old burn scar, *Am. J. Surg.* **54:** 457, 1941.
46. Glasser, S. T.: Sarcomatous degeneration on a varicose ulcer, *Am. J. Surg.* **43:** 776, 1939.
47. Harbitz, H. F.: Development of a tumor (fibrosarcoma) after injection of salvarsan, *Lancet* **1:** 70, 1927.
48. Pack, G. T., and Eberhart, W. F.: Rhabdomyosarcoma of skeletal muscle, *Surgery* **32:** 1023, 1952.
49. Seelig, M. G.: Compensation in one-trauma cancer, *J. Missouri M. A.* **44:** 27, 1947.
50. Anonymous: Medico-Legal. Trauma and sarcoma, *Brit. M. J.* **2:** 922, 1958.
51. Geshickter, C., and Copeland, M.: Tumors of Bone. Philadelphia, J. B. Lippincott Co., 1949.
52. Pack, G. T., and Ehrlich, H. E.: Neoplasms of the anterior abdominal wall with special consideration of desmoid tumors: experience with 391 cases and a collective review of the literature, *Internat. Abstr. Surg.* **79:** 177, 1944.
53. Gatchell, F. G.; Clagett, O. T., and McDonald, J. R.: Desmoid tumor of intercostal muscles and thoracic wall, *J. Thorac. Surg.* **34:** 184, 1957.
54. Tanz, S. S.: Fibrosarcoma following single trauma. Report of a case, *J. Internat. Coll. Surgeons* **27:** 620, 1957.
55. Clarke, T. W.; Walsh, W. S., and Schreck, R. R.: Surgical judgment in the management of soft tissue sarcomas arising in the extremities, *Surg. Clin. North America* **38:** 1405, 1958.
56. Carson, W. J.: Trauma and malignancy, *Am. J. Surg.* **59:** 420, 1943.
57. Kushner, D. S., and Szanto, P.: Diagnostic problems. Painful knee, drop foot, and hemoptysis, *J. A. M. A.* **165:** 2193, 1957.
58. Levinson, L. J., and Furst, N. J.: Trauma associated with malignancy, *J. M. Soc. New Jersey* **38:** 181, 1941.
59. La Rocca, J.: Cancer of the lung and trauma, *Rev. Asoc. méd. argent.* **59:** 1114, 1945.
60. Pfeffer, F.: The question of accidental injury as a cause of primary carcinoma of the lung or as a cause of its progression, *Med. Klinik* **35:** 1515, 1939.
61. Chauvin, H. F.: Dysembryoma of the testicle revealedly traumatism, *J. urol. méd. (Paris)* **65:** 99, 1959.
62. Kotin, P., and Kahler, J. E.: Possible role of trauma as a cocarcinogen: case report on an oil worker, *Cancer* **6:** 266, 1953.
63. Schreck, R.: Cutaneous carcinoma, *Arch. Path.* **31:** 434, 1941.
64. Pack, G. T., and Booher, R. J.: Localization of metastatic cancer by trauma, *New York State J. Med.* **49:** 1839, 1949.
65. Russell, W. D., and Clark, R. L., Jr.: Medico-legal considerations of trauma and other external influences in relationship to cancer, *Vanderbilt Law Review* **6:** 868, 1953.
66. Knox, L. C.: Trauma and tumors, *Arch. Path.* **7:** 274, 1929.

Abstracts of Current Literature

AMINE OXIDASE INHIBITORS IN THE TREATMENT OF ANGINA PECTORIS. PRELIMINARY REPORT ON MARPLAN AND TERSAVID.

Abrams, W. B.; Becker, M. C.; Lewis, D. W., and Killough, J. H. *Am. J. Cardiol.* **5:** 634 (May) 1960.

Isocarboxazid (Marplan) was administered in daily doses of 5 to 30 mg. for an average of 7.7 weeks (range 1 to 16 weeks) to 27 patients with angina pectoris. Their ages were between 46 and 86 years. The response was graded according to the severity of pain, the number of anginal attacks per week, and the requirement for nitroglycerin tablets per day. Among 23 patients treated longer than two weeks, the response was good or excellent in 16, and fair in 4. Treatment failed in 3 patients. A good result was obtained in 1 patient treated for less than two weeks. Treatment was discontinued by 3 patients who had had a poor response to long-acting nitrites and other commonly used medications. In 7 patients with a good or excellent effect, symptoms were exacerbated during a placebo period. In 3 others, benefit from the drug was maintained during a placebo period. Two patients with initial benefit from placebo maintained it when given the active drug. One patient did not improve during administration of either the drug or the placebo. Laboratory studies showed no significant changes except for small amounts of albumin in the urine of 9 patients, which was not an unusual finding for this type of patient. Side-effects consisted of orthostatic hypotension with syncope, 3; weakness, 4; dizziness, 3; insomnia, 2; and euphoria, fatigue, palpitation, constipation, dryness of the mouth, and tremor, 1 each. Death from myocardial infarction of 2 elderly patients with arteriosclerosis and of 1 with severe coronary artery disease probably was not related to the drug. Orthostatic hypotension could have been a contributing factor in 2 instances of cerebrovascular accident. Pivalylbenzhydrazine (Tersavid) was given to 78 patients (68 available for evaluation) in an average daily dosage of 75 mg. for periods of two weeks to eleven months (average, three months). Among 60 patients who received the drug for less than two weeks, the results were good or excellent in 36, and fair in 9. There were 5 treatment failures. Among 8 patients treated for two weeks or less, 2 had an excellent result, and 1 a fair response. Treatment failed in 5. Laboratory studies showed no adverse changes. Sixty-seven patients reported no side-effects. Those mentioned by 11 patients included dizziness, stomach cramps, palpitation, insomnia, sensation of warmth, throbbing of the head, gaseous eructation, depression, and euphoria. During treatment 3 subjects had a myocardial infarction and 8 had prolonged bouts of coronary insufficiency. This drug appeared to be a safe monoamine oxidase inhibitor for use in the symptomatic treatment of angina pectoris. The mechanisms of action of monoamine oxidase inhibitors in angina are discussed. These studies indicate that monoamine oxidase inhibitors do not interfere with the natural course of arteriosclerotic heart disease, and that the compounds tested represent a significant advance in the management of angina pectoris.

ÜBER DER VERÄNDERUNGEN DER NIERE IM HOHEN ALTER. (RENAL CHANGES IN ADVANCED AGE).

Beregi, E. *Acta morph. Acad. Sc. Hung.* **8/2:** 173, 1958; through Excerpta med. (Gerontol. & Geriatrics) **3:** 82 (Feb.) 1960.

The kidneys of 146 non-selected persons over 60 years of age were examined post mortem. Forty-five of them showed extension of the glomerular intracapillary connective tissue. The progress of the changes and number of affected glomeruli increased with age. No relationship to the presence of disease was found. In 10 cases the renal capsule was markedly thickened. In the subcapsular cortical matter a zone containing hyalinized glomeruli was seen in which the interstices were infiltrated with round cells. In 20 cases the changes were of a focal nature.

SULLE MODIFICAZIONI STRUTTURALI DELLE ARTERIE CEREBRALI ANTERIORE, MEDIA E POSTERIORE DELL'UOMO NELLE DIVERSE ETÀ (THE STRUCTURAL MODIFICATIONS IN THE ANTERIOR, MEDIAN AND POSTERIOR CEREBRAL ARTERIES OF MAN AT VARIOUS AGES).

Bucciante, G., and Zanella, E. *Ateneo parmense* **29**/Suppl. 4: 99, 1958; through Excerpta med. (Gerontol. & Geriatrics) **3:** 67 (Feb.) 1960.

An anatomic-microscopic study was made of segments of these arteries, from subjects ranging in age from infancy to senility. With the exception of the absence of an external elastic membrane, and of the scarcity of elastic material in the tunica media and adventitia, the cerebral arteries respond to aging in the same way as other arterial vessels of the muscular type. It is noted that the alterations do not occur uniformly in the three efferent branches of the circle of Willis, but that structural completion and senile alterations appear first and to a more marked degree in the arteries of the anterior segment (median and anterior cerebral arteries) than in those of the vertebro-basilar system (posterior cerebral arteries). This finding is in perfect agreement with observations in cerebral arteriography after simultaneous injection of the internal carotid and vertebral arteries, *i.e.*, that the circulation rate is higher in the efferent branches of the carotid segment than in those of the posterior region.

LES INDICATIONS DU TOFRANIL EN GÉRIATRIE. (INDICATIONS FOR TOFRANIL IN GERIATRICS).

Christe, P. *Schweiz. med. Wchnschr.* **90:** 586 (May 28) 1960.

Fifty-four patients with arteriosclerosis or senile dementia were treated with Tofranil according to the following daily dosage scheme: first week, 10 mg.; second week, 20 mg.; third week, 40 mg.; fourth week and following weeks, 50 mg. in two doses. In 4 patients, the dosage had to be reduced, but in 5 patients it was raised to 75 mg. per day. Fourteen patients died of intercurrent diseases during treatment, death in 3 being related to the administration of Tofranil. Treatment had to be interrupted in 14 patients because of complications. A total of 26 patients could be followed for six months or more. The findings were as follows: *1*) Under treatment with Tofranil spasmodic crying disappeared in 9 patients. Contact with the environment partially returned after two to three weeks. *2*) Emotional instability disappeared in 10 patients. Some were able to return to work, having regained an affective and social equilibrium. *3*) Hypochondriacal tendencies with preoccupation with illness and such manifestations as senile pruritus of the anal region, chronic constipation, abdominal pain, precordial spasm, and articular pain were overcome in 8 of 12 patients. *4*) Senile depression was ameliorated in all of 6 cases over a period of two or three weeks. *5*) Retardation of function was not affected by Tofranil in 9 patients. Subdepressive states were somewhat ameliorated. Tofranil in conjunction with methylphenydate gave a good result in 1 patient. *6*) Senile dementia was not benefited and treatment had to be interrupted in all 8 cases because of hallucinations, agitation, and the occurrence of a neurologic syndrome, the patient becoming aggressive. Complications in the other types of patients consisted of: facial congestion several minutes after ingestion of the drug in 5; aggressive or paranoic behavior, or both, in 2; delusions in 1; neurologic syndrome in 1; and confusional-oneiric crises in 4. Also in 1 patient, agitation produced by Tofranil may have had something to do with the fatal outcome.

THE HEART LUNG COEFFICIENT IN OLDER PEOPLE.

Cowan, N. R. *Brit. Heart J.* **21/2:** 238, 1959; through Excerpta med. (Gerontol. & Geriatrics) **3:** 73 (Feb.) 1960.

The value of the heart-lung coefficient in clinical medicine was assessed with reference to 242 men and 190 women, aged 60 to 89 years, who were in good health. The tenth and

ninetieth percentile limits of the heart-lung coefficient for the age groups 60 to 69, 70 to 79, and 80 to 89 are for men, 0.40 and 0.48, 0.42 and 0.50, and 0.42 and 0.52, respectively. The corresponding values for women are 0.45 and 0.53, 0.46 and 0.56, and 0.48 and 0.58. The application of the ratio of 1:2 to older women as a level of normality will yield misleading information concerning the existence of cardiac enlargement. Both sexes show a significant positive correlation between the heart-lung coefficient and age. In men this is due to an increase in the maximum transverse diameter of the heart with age, whereas in women it is the result of a significant negative correlation between the maximum transverse diameter of the chest and age. Further investigation is necessary to explain the increase in the heart-lung coefficient with age in women.

LA FUNZIONALITÀ RESPIRATORIA NEL VECCHIO (RESPIRATORY FUNCTION IN THE AGED).

Daddi, G., and Fazio, B. *Gior. Gerontol.* Suppl. 8: 19, 1960.

The most significant alterations of the pulmonary functions with advancing age are decreased total lung capacity, increased residual volume and dead space, and increased pulmonary ventilation/pulmonary diffusing capacity ratio. All these factors produce a reduction in ventilation and are ascribed to: (a) decreased "elasticity" of the lung together with a reduction of the pulmonary vascular bed, and (b) impairment of the cardiac activity because of the increased pulmonary vascular resistance. Such alterations are explained by failing tissues with subsequent anoxemia and hypocapnia and normal levels of HbO_2. (Authors' summary.)

THE FIBRINOLYTIC SYSTEM AND USE OF FIBRINOLYSIN IN MYOCARDIAL INFARCTION. PRELIMINARY REPORT.

DeLeon, A. C., Jr.; Bellet, S.; Tsitouris, G.; Lecks, L. E., and Sandberg, H. *Am. J. Cardiol.* **5:** 674 (May) 1960.

Significant levels of plasmin activity were not found by twenty-minute clot lysis time determinations in 28 normal subjects and in 30 patients with acute myocardial infarction. Significantly higher antiplasmin levels were found in patients with myocardial infarction as compared with normal control subjects. Ten patients with an acute myocardial infarction of seventy-two hours' or less duration were treated with plasmin intravenous infusion. In 6 patients, the initial dose was 100,000 units. In 1 patient, the dosage was tapered from 200,000 units to 100,000, 75,000, and 50,000 units on succeeding days. Another patient received 200,000 units initially and then 150,000 and 100,000 on two succeeding days. A febrile reaction occurred in 5 patients. Three patients with a high temperature noted chills, usually associated with mild transient hypotension, accompanied by flushing. Vomiting occurred in 1 patient. In 5 patients, improvement in ST segments and T-wave changes followed the infusion and probably were due to it. These electrocardiographic effects of infarction recurred when the thrombolysin effects disappeared. Eight of the 10 patients were relieved of precordial or substernal pain. No essential change was noted in the blood fibrinogen levels with doses of 100,000 units. Anticoagulants could be administered without difficulty and no hemorrhagic manifestations occurred. The results were interpreted as satisfactory, and encouraging enough to warrant further trial in a larger series.

THE HUMAN AORTA. VII. THE INFLUENCE OF CONTINUOUS HEPARIN TREATMENT ON ATHEROSCLEROSIS IN THE AORTA.

Faber, M., and Geill, T. *Arch. Path.* **70:** 244 (Aug.) 1960.

Fifty elderly men who were free of diabetes, known heart disease, and hypertension, received 10,000 units of a concentrated heparin solution twice weekly by subcutaneous injection. Administration was continued until death. The control group of 101 patients showed a mortality rate comparable with that in the treated group. No decrease in the

death rate due to cardiovascular disease was noted in the treated group. Heparin lowered the fasting chylomicron count in the days between the first injections. Previous heparin injection also lowered the chylomicron count after the ingestion of 250 ml. of cream. When the patients had died and the aortas were analyzed for cholesterol and calcium content, no differences were found between treated and untreated patients. There was no indication that continuous heparin treatment had caused a change in the rate of deposition of lipids in the wall of the aorta.

SEXUAL POTENCY IN AGING MALES. IV. STATUS OF PRIVATE PATIENTS BEFORE AND AFTER PROSTATECTOMY.

Finkle, A. L., and Moyers, T. G. *J. Urol.* **84:** 152 (July) 1960.

One hundred men aged 30 to 92 years undergoing prostatectomy were the subjects of this study. Fifty per cent of the group were sexually potent prior to operation. Increased age was sometimes, but not always, a factor in the decline of sexual potency. Men without a sexual partner were more frequently impotent. Sixty-nine per cent of these patients retained sexual potency following operation, there being little difference in the rate following the various operations. When sexual potency was retained postoperatively, vigor and frequency of coitus were unchanged in 50 per cent of patients. Two patients became potent following operation whereas they had been impotent for several years previously. Epididymitis was the most frequent operative complication. Vasoligations were not performed before or after operation in these patients. Temporary urinary incontinence occurred more than three months following partial prostatectomy in 1 patient with inoperable carcinoma. Complete continence was regained within eight months. The factors considered essential for preserving potency following operation were mutual desire by the partners, a kind and encouraging attitude on the part of the physician toward temporary sexual inadequacy, and good physical condition of both partners. Age was not an impediment.

ESTROGEN-TREATED PROSTATIC CANCER. THE VARIATION IN RESPONSIVENESS OF TUMOR CELLS.

Franks, L. M. *Cancer* **13:** 490 (May-June) 1960.

Fifty-two patients with prostatic carcinoma were studied at necropsy. All had been treated with estrogen for periods of two weeks to nine years. The dosage varied from 15 to 100 mg. of stilbestrol, or an equivalent amount of some other estrogen. The patients ranged in age from 50 to more than 90 years, the majority being in the seventh and eighth decades. Thirty-three patients died as a result of prostatic carcinoma, 8 postoperatively, 12 with multiple metastases, and 13 from urinary infection or obstruction. The survival times were similar to those in other series. Examination of the cause of death showed that many died of urinary obstruction and infection even though cancer cells in the primary tumor were inactive. It may be that life can be prolonged in such cases if obstruction by the tumor or fibrous tissue can be prevented before irreversible damage has been done to the kidney. The survival time was usually short in patients who received alternative treatment after estrogens had become ineffective. Histologically the patients fell into 4 groups: *1*) Six patients showed no degenerative changes in the tumor due to estrogen treatment. These tumors were the same in structure as those in untreated patients. *2*) In 10 patients the primary tumor and secondary deposits were inactive. Even though these tumors showed degenerative changes with small shrunken acini and dense knots and strands of shrunken cells in fibrous tissue, small clumps of undamaged cells could almost always be found. *3*) In 10 cases the primary tumor was inactive but the metastases were growing rapidly. The primary tumor was almost entirely replaced by fibrous tissue but there were deposits of active tumor cells. *4*) Twenty-six patients had active tumor in the prostate and in metastases but evi-

dence of previous estrogen effects could be seen, dense scar tissue indicating some tumor destruction. This study showed that all tumor cells do not respond to endocrine treatment. The response of parts of a tumor may differ. Thus, undamaged cells may appear in some tumors that show severe degenerative changes. Cells of high malignancy also vary in responsiveness. It is possible that endocrine treatment may affect only residual normal properties rather than neoplastic ones. The loss of normal components when the tumor grows may cause a corresponding loss in hormone sensitivity. It is not known whether the shrunken and distorted inactive cancer cells are capable of renewed activity or whether tumor growth always arises in the areas of surviving undamaged cells.

PREINVASIVE INTRADUCTAL CARCINOMA OF THE BREAST.

Gillis, D. A.; Dockerty, M. B., and Clagett, O. T. *Surg., Gynec. & Obst.* **110:** 555 (May) 1960.

Comedocarcinomas, that is, growths in which 75 per cent of the neoplastic tissue remains confined to the large ducts, represent about 6 per cent of all mammary carcinomas. In a series of 603 comedocarcinomas at the Mayo Clinic, 36 were entirely intraductal. These lesions were found to be entirely preinvasive. The majority of the patients were in the fifth and sixth decades of life; 2 were in the eighth. Symptomatically the patients fell into 4 groups: 1) a lump in the breast of three days' to five years' duration (42 per cent); 2) nipple discharge, usually bloody, for a few weeks to twenty-three years (25 per cent); 3) a lump, and nipple discharge (14 per cent); 4) no symptoms (17 per cent). In addition, 1 patient complained of painful breasts. The lumps varied from small nodules to a large mass. Some were discrete, others less well defined. Fixation of the skin, retraction of the nipple, cutaneous edema, or fixation of the lesion to deeper structures was not noted. One patient had a large firm axillary lymph node. The carcinoma in this patient was grade 4. Eighty per cent of the lesions were grades 1 and 2. The breasts appeared normal in 5 of 9 patients with nipple discharge. In the other 4 the affected region could be defined and in 2 of them pressure caused discharge from the nipple. Examination of blood and urine and postero-anterior stereoscopic roentgenograms of the thorax were not of benefit in arriving at a diagnosis, which was established by microscopic examination of excised tissue. When a lump was palpable, an excisional biopsy was first performed. A definitive surgical procedure was completed after the diagnosis had been made by a study of frozen sections. Pathologic studies showed the major gross change to be ductal dilatation with or without visible intraductal plugs of tumor. It was found that intraductal carcinoma of the breast could be present over a wide area without producing significant alterations in the gross appearance. Microscopically the most striking feature was the multiplicity of affected ducts. The earliest change is proliferation of cells lining major and minor ducts serving lobules. The ingrowth of cells often assumes a papillary structure but there is no stalk of connective tissue. At this stage the cells are not highly atypical, and mitotic figures seldom are seen. The papillary projections gradually coalesce to form a more solid intraductal tumor. Scattered spaces remain throughout the lumen. Cellular polarity decreases, and the incidence of mitotic figures and atypical cells increases. As the condition progresses the duct becomes almost filled with tumor cells. They outgrow their blood supply so that necrosis occurs, and this produces the comedocarcinoma. The final phase is failure of the wall to contain the tumor, so that stromal invasion occurs. Preinvasive intraductal carcinoma is an uncommon but distinctive manifestation of mammary carcinoma. Its identification requires careful microscopic study of involved tissue. A preliminary review of frozen sections is not sufficient for making a decision for or against radical surgical intervention. This study shows that carcinoma confined to the ducts does not involve the regional lymph nodes. Removal of a preinvasive intraductal carcinoma of the breast does not alter the life expectancy of the patient.

CARDIAC LESIONS IN RHEUMATOID ARTHRITIS.

Goehrs, H. R.; Baggenstoss, A. H., and Slocumb, C. H. *Arth. & Rheum.* **3:** 298 (Aug.) 1960.

A detailed necropsy study at the Mayo Clinic of the hearts of 36 patients who had rheumatoid arthritis has been recorded, along with a review of the clinical aspects in these cases. Only 2 of the patients gave histories suggestive of rheumatic fever, yet 16 of the hearts showed definite pathologic changes indicating previous rheumatic injury. From this it appears that subclinical rheumatic fever occurred in a significant number of these patients, or that rheumatic fever and rheumatoid arthritis cause a similar type of cardiac injury. In either case, the rather low incidence of severe damage to the valves indicates a mild form of injury. One-fifth of these hearts showed pathologic evidence of a characteristic rheumatoid granulomatous type of injury, with lesions at the base of the mitral and aortic valves, the wall of the left ventricle and left atrium, and the epicardium. Almost 70 per cent of the hearts exhibited hypertrophy, as indicated by weight. Pericarditis occurred in 42 per cent of the cases. Significant valvular sclerosis was noted in 42 per cent of the hearts, with the aortic and mitral valves being involved about equally, except that the aortic valve was more often severely involved. A total of 23 of the 36 hearts displayed either pericarditis or valvular sclerosis; these lesions had been diagnosed clinically in only 3 of these 23 cases (13 per cent). Death was attributable to heart disease in 8 of the 36 patients (22 per cent). (From authors' summary.)

A SIX-MONTH CONTINUOUS STUDY OF METHYPRYLON IN THE GERIATRIC PSYCHIATRIC PATIENT WITH INSOMNIA.

Goode, P. *New York J. Med.* **60:** 2546 (Aug. 15) 1960.

Insomnia is common among elderly people but it is more exaggerated when an organic psychosis is present. Patients with a psychiatric illness who suffer from chronic insomnia are unlikely to improve unless the latter is relieved. Typically, their symptoms are exacerbated in the early evening. There is likely to be severe insomnia complicated by hallucinations, confusion, anxiety, and fearful misinterpretations through the night. If such patients are "given" sleep, both the daytime and evening behavior is likely to improve. Methyprylon, a nonbarbiturate hypnotic, given over a six-month period in doses of 200 to 400 mg. to 42 geriatric psychiatric patients with insomnia had a soporific effect in 84 per cent of them. The drug diminished or eliminated pre-sleep disturbances, and nocturnal problems ceased. Forty-eight per cent of the patients showed improvement in psychiatric symptoms during treatment. Patients whose condition did not improve continued to respond to methyprylon. The 7 patients who failed to sleep well, regressed or remained unchanged. No side-effects occurred and patients experienced no grogginess upon awakening. The hypnotic effect obtained in these patients is judged a notable achievement.

EFFECT OF AN ANABOLIC AGENT (NILEVAR) ON NITROGEN AND MINERAL METABOLISM IN TWO PATIENTS WITH RHEUMATOID DISEASE.

Harris, J.; Blechman, W.; Young, N.; Malm, O., and Vaughan, J. H. *Arth. & Rheum.* **3:** 341 (Aug.) 1960.

In a case of acute rheumatoid arthritis treated with corticosteroids and in one of chronic rheumatoid arthritis, Nilevar in 30-mg. to 50-mg. doses induced nitrogen retention, so that nitrogen balance became positive. In the second patient, who was receiving a weight-reducing diet, the calcium and phosphorus balances became positive. Urinary 17-hydroxysteroids remained unchanged but 17-ketosteroids showed a significant decrease during administration of Nilevar. The symptoms of rheumatoid arthritis were not affected. No definite masculinizing effects were noted except for questionable enlargement of the prostate after one month of treatment in 1 patient. These observations indicate that Nilevar exerts an anabolic effect on protein and mineral metabolism and may be useful therapeutically.

LARGE CYSTS IN LOWER LEG ORIGINATING IN THE KNEE OCCURRING IN PATIENTS WITH RHEUMATOID ARTHRITIS.

Harvey, J. P., and Corcos, J. *Arth. & Rheum.* **3:** 218 (June) 1960.

Four patients receiving long-term steroid therapy for rheumatoid arthritis had unusual large masses in the calf, which were filled with fluid and communicated with the knee joint. Marked swelling of the knees had preceded enlargement of the calf. All had pain and tenderness in the calf. The diagnosis originally was thought to be thrombophlebitis, but cysts were demonstrated by arthrograms. The manner in which such cysts are formed has not been determined but their size indicates that perhaps they may be due to weakening of connective tissue structure by prolonged corticosteroid therapy. They have been found to disappear and recur with remission and exacerbation of rheumatoid arthritis. Surgical excision is indicated and will remove interference with gait and relieve leg discomfort; but with new rheumatoid activity, cysts will recur.

LE COEUR DU VIEILLARD NORMAL. A PROPOS DE 100 OBSERVATIONS. (THE HEART OF THE NORMAL AGED SUBJECT. REPORT OF 100 OBSERVATIONS).

Herbeuval, R.; Cuny, G.; Tenette, C., and Tenette, M. *Rev. franç. gérontol.* **4/6:** 399, 1958; through Excerpta med. (Gerontol. & Geriatrics) **3:** 83 (Feb.) 1960.

An analysis is given of the electrocardiograms of 100 subjects over age 70 without past cardiac history. The most frequent findings were: left axis deviation (36 patients, 19 of whom had hypertrophy of the left ventricle), coronary insufficiency (7 subjects), and femoral blockage (6 subjects). Long-standing cardiac infarction was found in 4 subjects, and recent cardiac infarction in 1 subject. Atrial extrasystoles were found in 8 cases, ventricular extrasystoles in 15 and atrial fibrillation in 5. No particular significance is attributed to distortions of the QRS complex and the extension of the QT time.

BILATERAL THALAMOTOMY IN PARKINSONISM.

Krayenbühl, H., and Yasargil, M. G. *J. Nerv. & Ment. Dis.* **130:** 538 (June) 1960.

Six patients who had bilateral thalamic operations with unipolar coagulation of the ventrolateral nucleus of the thalamus are presented. Lesions 200 to 250 cm. in size were made, using specially constructed unipolar electrodes. They were sufficiently large to relieve tremor and rigidity. When accurately placed, they resulted in no neurologic or intellectual deficit. The bilateral operation should be performed only in patients who tolerate the initial surgical procedure without complication and with a good lasting result. A time interval of six months is allowed between the two.

ALTERATIONS IN FAT AND NITROGEN METABOLISM AFTER TOTAL AND SUBTOTAL GASTRECTOMY.

Lawrence, W., Jr.; Vanamee, P.; Peterson, A. S.; McNeer, G., and Randall, H. T. *Surg., Gynec. & Obst.* **110:** 601 (May) 1960.

A series of 25 patients after total gastrectomy and 17 patients after partial gastrectomy were subjected to metabolic study. The mean fat absorption after total gastrectomy was 81.7 per cent of intake (normal range, 92 to 100 per cent), but there was much variation between patients. The percentage absorption of dietary fat in individual patients was completely unaffected by variations in fat intake, was generally decreased by increasing dietary carbohydrate, and usually was increased when hydrochloric acid supplements were administered. Protein absorption was also decreased after total gastrectomy. Increasing the dietary carbohydrate reduced nitrogen absorption, but total retention of nitrogen was slightly increased, as judged by urinary nitrogen measurements. Hydrochloric acid supple-

ments decreased protein absorption slightly, in contrast to the findings with fat absorption, but this did not cause a negative nitrogen balance. Comparing the mean dietary protein intake required to achieve "zero balance" after total gastrectomy with similar calculations from groups of normal subjects, demonstrated a definite increase in dietary nitrogen requirement for these patients. Metabolic studies of patients after partial gastrectomy showed similar, but less striking, variations in both fat and nitrogen metabolism. Comparison of our metabolic data with body-weight studies in the same patients showed a poor correlation between nutritional state and the observed absorption defects. The most important factor in adequate nutritional maintenance seemed to be the ability to control postprandial symptoms sufficiently to allow adequate intake. With careful dietary management the majority of these patients could be maintained in an adequate nutritional state, and this fact would seem to justify continued performance of total gastrectomy, when indicated, for cancer of the stomach. (From authors' summary.)

CUTANEOUS REFLEX CHANGES IN DEVELOPMENT AND AGING.

Magladery, J. W.; Teasdall, R. D.; French, J. H., and Busch, E. S. *A.M.A. Arch. Neurol.* **3:** 23 (July) 1960.

Plantar and superficial abdominal responses were studied electromyographically in normal subjects ranging in age from 1 day to 83 years. A lowered excitability, evidenced by longer latencies of both of these responses, was found in the young and in older persons as compared with young adults. Simple anticipated tactile reaction times in children were greater in comparison with young adults, and plantar flexor responses to strong electrical stimuli were slower. In these two responses, the elderly differed little from young adults. The sites and physiologic mechanisms affected in this slowing of reflex response are at present unknown. Regressive changes or immaturity at the periphery do not appear to be the causes. It may be that some alteration in central mechanisms accounts for the difference between young adults and young children and the elderly. These reflexes must not be considered as isolated mechanisms but as a part of the total motor activity. Possibly they are representative of many complicated basic reflex patterns, the interaction of which is essential to effective voluntary motor performance. If so, such reflexes and their modifiability by activity at higher levels in the central nervous system may be areas in which the study of physiologic mechanisms involved in development and aging might be undertaken profitably.

ACUTE HEMORRHAGIC NECROSIS OF THE GASTROINTESTINAL TRACT.

Ming, S., and Levitan, R. *New England J. Med.* **263:** 59 (July 14) 1960.

Eleven cases of extensive hemorrhagic necrosis of the gastrointestinal tract are presented. All patients had a prolonged illness before the onset of the bowel disturbance; 8 had chronic congestive heart failure, 1 had hypertension and cardiac arrhythmia without heart failure, 1 had gangrene of a leg, and 1 had acute peritonitis secondary to cholecystitis. All died in shock. Six had clinical evidence of gastro-intestinal bleeding, which was massive in 2. The abdominal symptoms and signs were comparatively meager. The pathology is distinct, consisting first of severe congestion and later of edema, extensive hemorrhage and superficial necrosis, involving chiefly the mucosa and submucosa and leading to massive intraluminal hemorrhage. Inflammation is usually mild or absent. The lesion can be either patchy or diffuse and often involves the entire gastro-intestinal tract. The etiology is unknown, and various contributory factors, including the role of shock in the genesis of the lesion, are discussed. This condition should be seriously considered in elderly, chronically ill patients who present vague abdominal complaints, sudden shock, and gastro-intestinal bleeding. (From authors' summary and conclusions.)

FISIOPATOLOGIA DEL PICCOLO CIRCOLO NELL'ETÀ SENILE (PHYSIOPATHOLOGY OF THE LESSER CIRCULATION IN THE SENILE STATE).

Panuccio, P. *Gior. Gerontol.* Suppl. 8: 197, 1960.

Ten normal subjects between 47 and 76 years of age were divided into three groups according to their biologic state of pre-senility, senility, and advanced senility. Cardiac catheterization showed the following results: 1) decreased cardiac outflow, 2) a normal pressure at all the levels of the lesser circulation, 3) total and arteriolar pulmonary resistance which seemed to be augmented when compared with that of normal subjects, and 4) a right ventricle which appeared in most cases to be working at a lower level. These changes became clearer with advancing age and the transition limit seemed to fall within the sixtieth year of life. They were considered a consequence of poorer cardiac output. In the second part of the study, some of the physiopathologic aspects of the cardiopulmonary circulation in the aged under pathologic conditions were examined, such as peripheral arterial hypertension and congenital heart disease with increased pulmonary blood flow. A slight hypertension of the lesser circulation was usually found, connected with an abnormal state which was similar to that of mitral heart disease and appeared before true heart failure was present. No relation was found between increased pulmonary blood flow, age, and hypertension of the lesser circulation. (From author's summary.)

ZUR FRAGE DER ALTERSABHÄNGIGKEIT DER ZIRKULIERENDEN BLUTMENGE UND DER BLUTSTRÖMUNGSGESCHWINDIGKEIT (THE DEPENDENCE ON AGE OF THE CIRCULATING MASS OF BLOOD AND OF THE VELOCITY OF THE BLOOD FLOW).

Schröder, J., and Börner, W. *Ärztl. Wchnschr.* **13/26:** 578, 1958; through Excerpta med. (Gerontol. & Geriatrics) **3:** 72 (Feb.) 1960.

The authors examined healthy old men, of whom 46 were between 74 and 92 years of age (average, 81.1 years) and 57 were between 50 and 59 years (average, 55.7 years), with reference to the dependence on age of the circulating mass of blood and of the velocity of the blood flow. The circulating plasma volume was determined according to the principle of dilution: intravenous injection of 2 ml. of physiologic sodium chloride solution which contained 8 to 10 μc of serum albumin labeled with I^{131}. The examinations took place in the morning between 7 and 10 o'clock. Within the two groups no difference in the circulating plasma volume per kilogram of body weight could be found by the authors. The hematocrit of the old men was on the average 1.4 volumes per cent lower than that of the younger test group, so that the calculated circulating erythrocyte and total volume in the older group averaged slightly less than those in the younger group. In both groups, however, the individual degree of variation and the plasma volume per kilogram, and thereby the calculated circulating erythrocyte and total volume, were rather high. Circulation time was lengthened in old age, but the individual variations in these values were considerable. The authors hold that reliable values may only be obtained if longitudinal examinations can be made, *i.e.*, when a group of middle-aged men can be examined methodically until the death of the test subjects. The fact that the persons in the test group under discussion were on the average 4.2 cm. shorter and 4.6 Kg. lighter than those in the younger test group points to the assumption that a decrease of the absolute values, as for example the circulating plasma and blood mass, does occur in old age, but is joined to a corresponding decrease of the body length, weight and surface. The authors also hold that a healthy old man does not show an essentially lowered circulating plasma and erythrocyte mass, independent of whether one uses the unit of body weight or of corporal surface as the criterion.

STUDIES OF THE PLASMIN-PLASMINOGEN SYSTEM IN THROMBOEMBOLIC DISEASES. ITS MODIFICATIONS BY THROMBOLYSIN THERAPY.

Tsitouris, G.; Sandberg, H.; DeLeon, A. C., Jr.; Lecks, L., and Bellet, S. *Am. J. Cardiol.* **5:** 680 (May) 1960.

The following tests were performed on blood samples from controls and 22 patients with thrombo-embolic disease: plasma fibrinogen, clot lysis by undiluted and diluted plasma, euglobulin lysis time and antiplasmin activity. In patients with thrombo-embolic disease, the plasma fibrinogen level was about 70 per cent above that in a control group. The antiplasmin activity was about 75 per cent greater than that of control subjects. After plasmin had been administered, antiplasmin activity and clot lysis time in dilute plasma declined, but the plasma fibrinogen level was only slightly diminished. Plasmin relieved pain in 4 of 5 patients with acute thrombophlebitis, but was ineffective in 1 patient treated fourteen days after onset of the disease. The drug was effective in 3 of 4 cases of pulmonary embolism, relieving pain and hemoptysis in 2 patients, and fever and rales in 1. The patient in whom plasmin was not effective was critically ill and had multiple emboli. In the remaining cases of thrombo-embolic disease, symptomatic changes due to the drug could not be differentiated from changes in the natural course and variability of the disease process, because the number of patients was too small. Temperature elevations of 1 to 5 degrees F. and hot flushes occurred in approximately 33 per cent of the patients. Blood pressure and pulse rates were not affected. Neither hemorrhagic diatheses nor recurrence of thrombophlebitic episodes were noted during therapy.

ADRENOCORTICAL FUNCTION IN CARCINOMA OF THE LUNG.

Werk, E. E., Jr., and Sholiton, L. J. *Cancer* **13:** 469 (May-June) 1960.

Finding elevated plasma and urinary 17-hydroxycorticosteroid levels but no clinical manifestations of Cushing's syndrome or hyperaldosteronism in a patient with bronchogenic carcinoma stimulated an interest in a possible relation between adrenocortical function and carcinoma of the lung. A study was carried out to evaluate adrenocortical function in men with carcinoma of the lung, by using direct steroid measurements. The results in patients with carcinoma were compared with those in men with chronic non-neoplastic medical disease (sick group), and men in a control group who had undergone minor elective surgical conditions. The carcinoma patients had higher basal plasma free 17-hydroxycorticosteroid levels than did the other two groups; after ACTH, the mean values in the carcinoma group also were higher. Carcinoma patients also showed higher basal urinary steroid excretion but the differences were less distinct than the differences in plasma values. The basal urinary 17-hydroxycorticosteroid excretion, which was higher in the cancer group, correlated with the elevated basal plasma level of free 17-hydroxycorticosteroids. After ACTH, urinary steroid outputs were similar in all three groups but the values related to creatinine excretion were higher in patients with carcinoma. It was determined at necropsy that the adrenal cortices of patients with carcinoma of the lung were slightly thicker than those in patients of the other two groups. Why there should be increased adrenal steroid output in carcinoma of the lung is speculative. Current studies of adrenal function favor the belief that the "stress" of the carcinoma over a prolonged period serves as a stimulus to the pituitary-adrenal system, but conclusions cannot yet be reached.

AMYLOIDOSIS IN SENILE AND PRE-SENILE INVOLUTIONAL PROCESSES OF THE CENTRAL NERVOUS SYSTEM.

Van der Horst, L.; Stam, F. C., and Wigboldus, J. M. *J. Nerv. & Ment. Dis.* **130:** 578 (June) 1960.

A brief historical review of the literature on amyloid deposition in aged subjects, and on the relation between amyloidosis and senile plaques, is presented. Since Divry first con-

tended, in 1927, that senile plaques are a manifestation of amyloidosis, many investigators have tested senile plaques for the presence of amyloid. The results obtained are widely varied. Many authors who demonstrated amyloid in senile plaques are opposed by as many investigators who failed to find amyloid in the plaques. The investigation described showed that four morphologic types of senile plaques can be distinguished. Histochemical analyses of these plaque types showed that plaques of types I, II and III contained amyloid, whereas those of Type IV did not. On the basis of the morphologic aspects and the histochemical analysis of senile plaques, the hypothesis is presented that senile plaques are a manifestation of senile amyloidosis which starts by deposit of amyloid in the brain tissue, followed by a reaction of the adjacent cerebral parenchyma, after which the amyloid is gradually absorbed until only a plaque scar is left in the cerebral tissue, which no longer contains any amyloid. The four plaque types described, therefore, represent four consecutive phases in the plaque-forming process. The amyloid is likely to be deposited via the vessels, as senile plaques in the brain were almost always associated with congophile angiopathy of the cerebral vessels. It is pointed out that this amyloidosis of old age is not confined to the brain. Investigations made in a number of cases of amyloidosis of the central nervous system showed that amyloid deposits, and congophile angiopathies, can also be found in various other organs, such as the lungs, heart, kidneys, liver and pancreas. (From authors' summary.)

SYMMETRICAL GANGRENE ASSOCIATED WITH CORONARY THROMBOSIS.

Wilcox, L. D. *Canad. M. A. J.* **82:** 1066 (May 21) 1960.

Five clinical situations are discussed in which serious and sometimes reversible peripheral ischemia places survival of the extremities in jeopardy. The fingers and nose also may suffer. 1) *Cardiac-embolic ischemia. a.* Saddle embolism should be considered when the legs become cold and pulseless two or three weeks after a coronary thrombosis. Immediate surgery is indicated. If the diagnosis is missed in the first few hours, there is a 50 per cent chance that gangrene will occur, and death may result. Saddle embolism probably is rare because of the use of anticoagulants. *b.* Multiple embolization also may follow myocardial infarction. This is illustrated by a 59-year-old man with acute abdominal pain, leukocytosis, and vomiting in the presence of acquired vascular insufficiency of the lower legs and feet. 2) *Prolonged myocardial shock with gangrene.* The decreased cardiac output, compensatory peripheral vasoconstriction, and frequently associated bradycardia or tachycardia lead to marked vascular insufficiency of the distal parts. This type of ischemia usually is nonocclusive, but it may become so if the patient lives long enough. A case presented exemplifies the nonocclusive form of symmetrical ischemia. The second case is an example of the occlusive type, all of the tibial vessels being filled with thrombus. The management of these conditions depends upon the maintenance of an adequate blood pressure. Because of the likelihood of thrombosis, anticoagulants should be used routinely. Vasodilators may be contraindicated. 3) *Acute onset of the Leriche syndrome with coronary occlusion.* Progressive thrombosis with occlusion of the terminal part of the atheromatous abdominal aorta may occur. The tendency to thrombosis during a coronary attack may be increased in all parts of the body. The patient presented had paralysis of one leg, and its deep reflexes were absent. When this condition is suspected following coronary occlusion, roentgenograms of the abdominal aorta should be obtained to look for calcification, and followed by aortography to determine the extent of the occlusion. The condition should be explored surgically and managed by lumbar sympathectomy, thrombendarterectomy, or aorto-iliac resection. 4) *Aorto-pedal embolic group.* Embolization of atheromatous material from a diseased aorta can occur even during treatment with anticoagulants. The findings include a color change in the toes and bilateral loss of dorsalis pedis pulsation in a patient with a coronary attack. When a patient with coronary thrombosis lies on his back, increasing pultaceous thrombus masses may form over eroded areas in the aorto-iliac segment. Material carried from such a mass may be directed into the anterior tibial circulation so that symmetrical gangrene occurs in the forefoot.

In this situation, a roentgenogram of the distal aorta and the tibial vessels should be obtained and followed by an aortogram if calcium deposits are found in the aorta. Biopsy of the functional dorsalis pedis artery looking for typical acicular spaces would be unnecessary to confirm the diagnosis. In patients with ischemic changes in the toes (which may be associated with petechial hemorrhages) or loss of dorsalis pedis pulses in association with good posterior tibial pulses (supporting aortogram), thrombendarterectomy or resection of the diseased segment of the aorta and iliac arteries should be considered. *5) Thrombosis with polycythemia vera.* A case is presented of polycythemia with coronary thrombosis in which gangrene occurred in the four extremities and the patient suffered a cerebral infarction. Coronary thrombosis is increasing in frequency due to greater life expectancy. Therefore, the clinical picture of symmetrical gangrene may occur more often. The prognosis usually is poor. In collaboration with the vascular surgeon, reasonable diagnostic accuracy is attainable; some cases can be prevented and others treated effectively.

A METHOD FOR EQUATING AGE AND ARTERIOSCLEROSIS AT NECROPSY.
Wilens, S. L., and Plair, C. M. *Arch. Path.* **70:** 149 (Aug.) 1960.

A simple method for grading the severity of sclerotic changes in the aorta by comparing each vessel at the time of necropsy to large photographic reproductions of aortas selected to reveal the average degree of sclerosis usually found in each age group is described. Among the advantages of this method are: 1) elimination, to a large extent, of the subjective factor on the part of the observer in grading the degree of sclerosis, 2) assurance of a good degree of uniformity in grading of sclerotic changes by different observers, and 3) availability of comparable recorded grades in necropsy protocols for purposes of analyzing factors that influence the development of arteriosclerosis. Certain pertinent findings concerning the relationship of age to arteriosclerosis, worthy of emphasis, became evident during this study: *1.* In the average man (about 1 out of 2), arteriosclerosis progresses to about the same extent throughout life. *2.* In exceptional persons (about 1 in 8) the sclerotic process is significantly retarded. *3.* In about the same proportion, it is accelerated. *4.* Of all factors that influence the development of arteriosclerosis, age is undoubtedly pre-eminent. *5.* Although the degree of sclerosis of the aorta is not an infallible guide to the severity of generalized arteriosclerosis in any man, collected statistics from a large group reveal a close association. *6.* Among men in whom arteriosclerosis develops at an average rate, about 1 in 8 will have, before death, some lesion due to arteriosclerosis. *7.* Myocardial infarction occurs almost as frequently in men with a scant amount of aortic sclerosis as in those with an average amount. *8.* Even a slight increase above average in the rate of development of arteriosclerosis causes a marked increase in the incidence of myocardial infarction. *9.* The gradual enlargement of the lumen of arteries that occurs with advancing age is sufficient in the average person to maintain an adequate blood flow in spite of encroachment on it by intimal plaques. *10.* The rate of development of arteriosclerosis is more important in the pathogenesis of lesions due to arteriosclerosis than the actual severity of the process. A young man with a moderate degree of sclerosis which is nevertheless greater than usual for his age may be more vulnerable to myocardial infarction than an older man with much more severe sclerosis which is nevertheless average for his age. This somewhat paradoxical situation tends to obscure the relationship of age to arteriosclerosis clinically. (From authors' summary.)

NEWS AND NOTICES

PROGRAM FOR REHABILITATION CARE—UNIVERSITY OF MICHIGAN

University of Michigan medical and social researchers have helped make a taxpayer's dream come true. They've shown how county hospitals can provide better services to more elderly people at no increase in cost. The secret: rehabilitation, a program that "pays" for itself. Working in cooperation with the staffs of the Washtenaw and Jackson County Hospitals, the U-M experts have shown that rehabilitation helps three out of four elderly persons achieve higher levels of independence and self-sufficiency. Moreover, within a year, nearly half those over 65 in the two hospitals were able to become active members of their community, either maintaining themselves completely at home (14 per cent) or requiring only a minimum amount of outside help (30 per cent).

The U-M project was conducted by the Division of Gerontology and The Medical School with financial support from the U. S. Office of Vocational Rehabilitation and the National Institutes of Health.

Summing up results, Wilma Donahue, Ph.D., chairman of the Division of Gerontology, says, "Rehabilitative care of patients need be no more costly than custodial care."

At the Jackson County Hospital, for example, one-fifth of the elderly patients involved in the rehabilitation project were discharged to lower-cost facilities after the nine-month program. Even if some of these discharged patients require further hospital care, the county can save approximately $1,100 annually for each person restored to the community.

"The cost of physical, psychological, and social services needed for rehabilitation just about matches this figure," Donahue notes. "Still, the community at no increase in cost can provide better service and can care for more patients if the discharge rate made possible by 'rehab' services remains high."

On a long-term basis, she concludes, the U-M demonstration project has had important effects in both communities: "Both hospitals have added staff in order to continue all the specific therapeutic programs instituted during the demonstration. The nursing staff is being upgraded by the addition of more trained personnel.

"The Washtenaw Hospital Medical Service has been brought under the aegis of the U-M Hospital, which now provides the services of a medical director and two residents.

"The Jackson community voted on a bond issue to build a new county facility which will be located within the city and will provide a rehabilitation out-patient clinic, sheltered workshop, and other services to the community as a whole, thus insuring reduction of isolation of the hospital patients."

In this situation, a roentgenogram of the distal aorta and the tibial vessels should be obtained and followed by an aortogram if calcium deposits are found in the aorta. Biopsy of the functional dorsalis pedis artery looking for typical acicular spaces would be unnecessary to confirm the diagnosis. In patients with ischemic changes in the toes (which may be associated with petechial hemorrhages) or loss of dorsalis pedis pulses in association with good posterior tibial pulses (supporting aortogram), thrombendarterectomy or resection of the diseased segment of the aorta and iliac arteries should be considered. 5) *Thrombosis with polycythemia vera.* A case is presented of polycythemia with coronary thrombosis in which gangrene occurred in the four extremities and the patient suffered a cerebral infarction. Coronary thrombosis is increasing in frequency due to greater life expectancy. Therefore, the clinical picture of symmetrical gangrene may occur more often. The prognosis usually is poor. In collaboration with the vascular surgeon, reasonable diagnostic accuracy is attainable; some cases can be prevented and others treated effectively.

A METHOD FOR EQUATING AGE AND ARTERIOSCLEROSIS AT NECROPSY.
Wilens, S. L., and Plair, C. M. *Arch. Path.* **70:** 149 (Aug.) 1960.

A simple method for grading the severity of sclerotic changes in the aorta by comparing each vessel at the time of necropsy to large photographic reproductions of aortas selected to reveal the average degree of sclerosis usually found in each age group is described. Among the advantages of this method are: 1) elimination, to a large extent, of the subjective factor on the part of the observer in grading the degree of sclerosis, 2) assurance of a good degree of uniformity in grading of sclerotic changes by different observers, and 3) availability of comparable recorded grades in necropsy protocols for purposes of analyzing factors that influence the development of arteriosclerosis. Certain pertinent findings concerning the relationship of age to arteriosclerosis, worthy of emphasis, became evident during this study: *1.* In the average man (about 1 out of 2), arteriosclerosis progresses to about the same extent throughout life. *2.* In exceptional persons (about 1 in 8) the sclerotic process is significantly retarded. *3.* In about the same proportion, it is accelerated. *4.* Of all factors that influence the development of arteriosclerosis, age is undoubtedly pre-eminent. *5.* Although the degree of sclerosis of the aorta is not an infallible guide to the severity of generalized arteriosclerosis in any man, collected statistics from a large group reveal a close association. *6.* Among men in whom arteriosclerosis develops at an average rate, about 1 in 8 will have, before death, some lesion due to arteriosclerosis. *7.* Myocardial infarction occurs almost as frequently in men with a scant amount of aortic sclerosis as in those with an average amount. *8.* Even a slight increase above average in the rate of development of arteriosclerosis causes a marked increase in the incidence of myocardial infarction. *9.* The gradual enlargement of the lumen of arteries that occurs with advancing age is sufficient in the average person to maintain an adequate blood flow in spite of encroachment on it by intimal plaques. *10.* The rate of development of arteriosclerosis is more important in the pathogenesis of lesions due to arteriosclerosis than the actual severity of the process. A young man with a moderate degree of sclerosis which is nevertheless greater than usual for his age may be more vulnerable to myocardial infarction than an older man with much more severe sclerosis which is nevertheless average for his age. This somewhat paradoxical situation tends to obscure the relationship of age to arteriosclerosis clinically. (From authors' summary.)

NEWS AND NOTICES

PROGRAM FOR REHABILITATION CARE—UNIVERSITY OF MICHIGAN

University of Michigan medical and social researchers have helped make a taxpayer's dream come true. They've shown how county hospitals can provide better services to more elderly people at no increase in cost. The secret: rehabilitation, a program that "pays" for itself. Working in cooperation with the staffs of the Washtenaw and Jackson County Hospitals, the U-M experts have shown that rehabilitation helps three out of four elderly persons achieve higher levels of independence and self-sufficiency. Moreover, within a year, nearly half those over 65 in the two hospitals were able to become active members of their community, either maintaining themselves completely at home (14 per cent) or requiring only a minimum amount of outside help (30 per cent).

The U-M project was conducted by the Division of Gerontology and The Medical School with financial support from the U. S. Office of Vocational Rehabilitation and the National Institutes of Health.

Summing up results, Wilma Donahue, Ph.D., chairman of the Division of Gerontology, says, "Rehabilitative care of patients need be no more costly than custodial care."

At the Jackson County Hospital, for example, one-fifth of the elderly patients involved in the rehabilitation project were discharged to lower-cost facilities after the nine-month program. Even if some of these discharged patients require further hospital care, the county can save approximately $1,100 annually for each person restored to the community.

"The cost of physical, psychological, and social services needed for rehabilitation just about matches this figure," Donahue notes. "Still, the community at no increase in cost can provide better service and can care for more patients if the discharge rate made possible by 'rehab' services remains high."

On a long-term basis, she concludes, the U-M demonstration project has had important effects in both communities: "Both hospitals have added staff in order to continue all the specific therapeutic programs instituted during the demonstration. The nursing staff is being upgraded by the addition of more trained personnel.

"The Washtenaw Hospital Medical Service has been brought under the aegis of the U-M Hospital, which now provides the services of a medical director and two residents.

"The Jackson community voted on a bond issue to build a new county facility which will be located within the city and will provide a rehabilitation out-patient clinic, sheltered workshop, and other services to the community as a whole, thus insuring reduction of isolation of the hospital patients."

BOOKS RECEIVED

Receipt of the following books for review is hereby acknowledged. We are glad to publish complete listings of all new books received but such listing must be regarded as a sufficient return for the courtesy of the sender. Books of particular interest will be reviewed in full as time and space permit. Additional information in regard to all listed books will be gladly furnished upon request.

INSULIN is the subject of the September 1960 number of the *British Medical Bulletin* (Vol. 16, No. 3). This colloquium, which cannot fail to interest biochemist, chemist, clinician, endocrinologist, pathologist and physiologist alike, has had *Professor F. G. Young* as its Scientific Editor, who has also contributed the stimulating Introduction. The number begins with the story of 40 years of research in insulin by Best, its co-discoverer with Sir Frederick Banting. This is followed by an account of the chemistry of insulin by Sanger, based on his Nobel Prize Lecture. Included also are up-to-date and well-documented reviews on insulin in blood, insulin antagonists and antibodies, as well as papers on the action of insulin on carbohydrate metabolism, on fatty acids and protein metabolism. Four of the contributions deal with the purely clinical side of the picture. Paper. $3.25. Medical Department, The British Council, 65 Davies Street, London, W.1, England.

THE MODERN TREATMENT OF ASTHMA, WITH SPECIAL REFERENCE TO GOLD THERAPY. By *L. Banszky, M.D. (Berlin), L.M.S.S.A. (Lond.)*. Second Edition. Cloth. $5.00. Pp. 175. John Wright & Sons Ltd., Bristol, England, 1959. The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.

NEOPLASTIC DISEASE AT VARIOUS SITES. Introductory Volume—A CLINICAL PROSPECT OF THE CANCER PROBLEM. By *D. W. Smithers, M.D., F.R.C.P., F.F.R.*, Professor of Radiotherapy in the University of London; Director, Radiotherapy Department, Royal Marsden Hospital, and Institute of Cancer Research, Royal Cancer Hospital; Radiotherapist, Brompton Hospital. Cloth. $8.50. Pp. 232. E. & S. Livingstone Ltd., Edinburgh and London, 1960. The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.

MANAGEMENT OF THE AGED SURGICAL PATIENT. By *Sidney E. Ziffren, M.D.*, Professor of Surgery, State University of Iowa College of Medicine. With chapters on ANESTHESIA, by *Stuart C. Cullen, M.D.*, Professor and Head, Department of Anesthesia, University of California School of Medicine; UROLOGY, by *Rubin H. Flocks, M.D.*, Professor and Head, Department of Urology, State University of Iowa College of Medicine; and a discussion of THE CARDIAC AND DIABETIC PATIENT FACING EMERGENCY OPERATION, by *Raymond F. Sheets, M.D.*, Associate Professor, Department of Internal Medicine, State University of Iowa College of Medicine. Cloth. $7.50. Pp. 219. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois, 1960.

GASTRIC CYTOLOGY—PRINCIPLES, METHODS AND RESULTS. By *Rudolf Otto Karl Schade, M.D. (Dunelm), M.D. (Tübingen), L.R.C.P., M.R.C.S.*, Senior

Lecturer, Department of Pathology, Royal Victoria Infirmary, Kings College, University of Durham. Cloth $8.00. Pp. 83. Edward Arnold (Publishers) Ltd., London, 1960. The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.

DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL SURGERY. By *Hamilton Bailey, F.R.C.S. (Eng.), F.A.C.S., F.R.S.E.*, Emeritus Surgeon, Royal Northern Hospital, London; Consulting Surgeon, Italian Hospital; General Surgeon, Metropolitan Ear, Nose and Throat Hospital; Vice-President, International College of Surgeons; formerly Hunterian Professor, Royal College of Surgeons and External Examiner in Surgery, University of Bristol. Thirteenth Edition. Cloth. $14.50. Pp. 928. With 1142 illustrations, of which 58 are unnumbered. John Wright & Sons Ltd., Bristol, England, 1960. The Williams & Wilkins Co., Baltimore, exclusive U. S. agents.

CELLULAR ASPECTS OF IMMUNITY—Ciba Foundation Symposium. Editors for the Ciba Foundation: *G. E. W. Wolstenholme, O.B.E., M.A., M.B., M.R.C.P.* and *Maeve O'Connor, B.A.* Cloth. $10.50. Pp. 495, with 117 illustrations. J. & A. Churchill Ltd., London, 1960; Little, Brown and Company, 34 Beacon Street, Boston 6, Massachusetts.

Books for review should be sent to Edward Henderson, M.D., Editor-in-Chief, 236 Midland Avenue, Montclair, New Jersey.